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The Impact of Bicycle Corridors on Travel Demand in Utah

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ABSTRACT

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Bicycling as an alternate mode of transportation has been on the rise. It is environmentally friendly in nature and the associated health benefits have made it a popular choice for many types of trips. The purpose of this research is to increase understanding of the impacts of implementing bicycle corridors (as part of the Utah Department of Transportation's (UDOT) *Inclusion of Active Transportation* policy) on bicycle rate as a function of roadway characteristics. The results of this research will be used in determining when and where bicycle corridors will enhance the transportation system and an estimate of the overall impact of bicycle corridors on travel demand in Utah.

Data collection was fundamental in this research project in determining the impacts of bicycle corridors on travel demands in the state of Utah. With limited amount of commuting bicycle data available throughout the state, it was necessary to gather bicycle volume data on corridors with and without bicycle infrastructure. In order to accomplish this data collection effort, two primary methods were used to collect bicycle volume data. The first method was to use automatic bicycle counters on roadways that had bicycle infrastructure. The second method was to gather bicycle volume data through manual counts on roads with and without bicycle infrastructure.

After the bicycle volume data were collected the data were analyzed to identify trends. The first step in the analysis was to convert the bicycle volumes into rates to provide a more uniform comparison. Several analyses were run including an analysis of bicycle rate compared to Annual Average Daily Traffic (AADT), bicycle rate compared to posted speed limit, bicycle rate compared to number of vehicle lanes, and bicycle rate compared to roadway classification. A comparison of sites with bicycle infrastructure to sites without bicycle infrastructure (non-bicycle infrastructure) was also conducted to identify relationships.

Comparison of bicycle rates to AADT resulted in no correlation or statistical relationship in the data but the data do suggest trends. Statistically significant results did occur when comparing bicycle rates to posted speed limits. No statistically significant relationships occurred when comparing bicycle rates to the number of lanes or roadway classification. It was determined that roadways with bicycle infrastructure tend to yield higher bicycle rates than roadways that do not have bicycle infrastructure. Lastly, using shared use path data it is determined that bicycle rates on shared use paths have increased between 1.7 to 7.5 percent from 2013 to 2014 and it is assumed that a similar trend would exist on bicycle infrastructure in the communities.

Keywords: AADT, bicycle infrastructure, bicycle rate, bicycle volume, posted speed limit, roadway classification, statistical significance, vehicle lanes

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TABLE OF CONTENTS

LIST OF TABLES xi

LIST OF FIGURES xviii

1 Introduction 1

1.1 Objectives 1

1.2 Scope 2

1.3 Outline of Thesis 3

2 Literature Review 5

2.1 Overview 5

2.2 Active Transportation Policies 5

2.2.1 Utah Active Transportation Policy 6

2.2.2 Colorado Active Transportation Policy 6

2.2.3 Minnesota Active Transportation Policy 7

2.2.4 Washington State Active Transportation Policy 7

2.2.5 Oregon Active Transportation Policy 7

2.3 Bicycle Implementation Plans 8

2.3.1 Salt Lake County, UT 8

2.3.2 Salt Lake City, UT 9

2.3.3 Provo, UT 10

2.3.4 Orem, UT 11

2.3.5 Boulder, CO 12

2.3.6 Seattle, WA 12

2.3.7 Portland, OR 13

2.4 Impact of Bicycle Corridors on Bicycle and Vehicle Mode Split 14

2.5 Impact of Bicycle Corridors in Combination with Vehicle Lanes 15

2.6 Planning and Constructing Bicycle Corridors 16
2.6.1 Infrastructure and Environment of Bicycle Corridors 16
2.6.1.1 Shared Lanes 16
2.6.1.2 Shared Lanes (Wide Outside Lanes) 17
2.6.1.3 Marked Shared Lanes 18
2.6.1.4 Paved Shoulders 19
2.6.1.5 Bike Lanes 20
2.6.1.6 Bicycle Boulevards 21
2.6.1.7 Shared Use Paths (Independent Right-of-Way) 22
2.6.1.8 Shared Use Paths (Adjacent to Roadways) 23
2.6.2 Bicycle Operation and Safety 25
2.6.3 User Behavior 25
2.7 Chapter Summary 26
3 Review of the Active Transportation Policy 27
3.1 Overview 27
3.2 UDOT Internal Survey 27
3.2.1 Familiarity with UDOT Active Transportation Policy 28
3.2.2 Policy Requirement of Regions 28
3.2.3 Implementation of Policy at Region Level 29
3.2.4 Barriers and Successes of Policy Implementation 30
3.2.5 Effectively Applying Policy at Region Level 30
3.2.6 Incorporation of Policy in Planning and Implementation 31
3.2.7 Specific Guidelines During Project Scoping 31
3.2.8 Outside of Scope 32
3.2.9 Feedback for Other Regions 33

3.3 Household Survey 33
3.3.1 Reasons for Not Bicycling 38
3.3.2 Purpose for Bicycling 43
3.3.3 Limitations to Data 53
3.3.4 Final Thoughts on the Data 54
3.4 Chapter Summary 54
4 Research Methods 56
4.1 Overview 56
4.2 Automatic Bicycle Counters 56
4.2.1 Equipment 57
4.2.2 Procedures 58
4.3 Manual Bicycle Counting 62
4.4 Chapter Summary 66
5 Data Collection 67
5.1 Overview 67
5.2 Davis County 68
5.2.1 Site D1: 1700 South at 1518 West, Syracuse 69
5.2.2 Site D2: 2700 South at 1518 West, Syracuse 71
5.3 Salt Lake County 73
5.3.1 Site SL1: Main Street at 550 South, Salt Lake City 74
5.3.2 Site SL2: 500 East at 750 South, Salt Lake City 77
5.3.3 Site SL3: 600 East at 550 South, Salt Lake City 79
5.3.4 Site SL4: 700 East (SR 71) at 550 South, Salt Lake City 81
5.3.5 Site SL5: 700 East (SR 71) at 9662 South, Sandy 83
5.3.6 Site SL6: State Street at 9662 South, Sandy 85

5.3.7 Site SL7: 10600 South at 1450 West, South Jordan ... 87
5.3.8 Site SL8: 11400 South at 1250 West, South Jordan ... 90
5.4 Utah County ... 92
5.4.1 Site U1: 800 North at 480 West, Orem ... 94
5.4.2 Site U2: 400 North at 350 West, Orem ... 97
5.4.3 Site U3: 800 South at 482 West, Orem ... 99
5.4.4 Site U4: 400 South at 482 West, Orem ... 101
5.4.5 Site U5: Orem Boulevard at 250 North, Orem ... 103
5.4.6 Site U6: 400 West at 250 North, Orem ... 106
5.4.7 Site U7: University Avenue at Marrcrest East, Provo ... 108
5.4.8 Site U8: North Canyon Road at 2850 North, Provo ... 110
5.4.9 Site U9: Provo River Trail at 1720 North, Provo ... 112
5.4.10 Site U10: Freedom Boulevard at 1720 North, Provo ... 114
5.4.11 Site U11: 800 North at 400 West, Provo ... 116
5.4.12 Site U12: 500 North at 400 West, Provo ... 118
5.4.13 Site U13: Freedom Boulevard at 650 North, Provo ... 120
5.4.14 Site U14: 500 West at 650 North, Provo ... 122
5.4.15 Site U15: Freedom Boulevard at 450 South, Provo ... 124
5.4.16 Site U16: 500 West at 450 South, Provo ... 127
5.4.17 Site U17: Center Street at 350 East, Provo ... 129
5.4.18 Site U18: 300 South at 330 East, Provo ... 131
5.4.19 Site U19: 200 East at 450 North, Provo ... 133
5.4.20 Site U20: 100 East at 450 North, Provo ... 135
5.4.21 Site U21: Center Street at 300 East, Springville ... 137
5.4.22 Site U22: 100 South at 300 East, Springville ... 139

5.5 Washington County ... 141
5.5.1 Site WA1: 700 East at 150 South, St. George ... 142
5.5.2 Site WA2: 600 East at 150 South, St. George ... 144
5.5.3 Site WA3: 400 East at 350 South, St. George ... 146
5.5.4 Site WA4: 300 South at 650 East, St. George ... 148
5.5.5 Site WA5: 400 South at 650 East, St. George ... 150
5.6 Weber County ... 152
5.6.1 Site WE1: Grant Avenue at 2125 South, Ogden ... 153
5.6.2 Site WE2: Lincoln Avenue at 2125 South, Ogden ... 154
5.6.3 Site WE3: Grant Avenue at 2550 South, Ogden ... 156
5.6.4 Site WE4: Lincoln Avenue at 2550 South, Ogden ... 158
5.7 Chapter Summary ... 160
6 Data Evaluation ... 161
6.1 Overview ... 161
6.2 Bicycle Rate Compared to AADT ... 161
6.2.1 All Sites ... 162
6.2.2 Sites With Bicycle Infrastructure ... 164
6.2.3 Sites Without Bicycle Infrastructure ... 166
6.3 Bicycle Rates Compared to Posted Speed Limit ... 168
6.3.1 All Sites ... 168
6.3.2 Sites With Bicycle Infrastructure ... 170
6.3.3 Sites Without Bicycle Infrastructure ... 171
6.4 Bicycle Rates Compared to Number of Vehicle Lanes ... 173
6.4.1 All Sites ... 173
6.4.2 Sites With Bicycle Infrastructure ... 174

6.4.3 Sites Without Bicycle Infrastructure 176
6.5 Bicycle Rates Compared to Roadway Classification 177
6.5.1 All Sites 178
6.5.2 Sites With Bicycle Infrastructure 179
6.5.3 Sites Without Bicycle Infrastructure 181
6.6 Bicycle Infrastructure versus Non-Bicycle Infrastructure 182
6.6.1 Inclusion of Washington County 183
6.6.2 Exclusion of Washington County 184
6.7 Additional Trends 185
6.7.1 College Connector Trail 185
6.7.2 Provo River Trail 186
6.7.3 Murdock Canal Trail 187
6.8 Chapter Summary 188
7 Conclusions and Recommendations 189
7.1 Summary 189
7.2 Findings 191
7.2.1 Bicycle Rates Compared to AADT 192
7.2.2 Bicycle Rates Compared to Posted Speed Limit Findings 193
7.2.3 Bicycle Rates Compared to Number of Lanes Findings 194
7.2.4 Bicycle Rates Compared to Roadway Classification 194
7.2.5 Bicycle Infrastructure versus Non-Bicycle Infrastructure 195
7.2.6 Additional Trends 197
7.3 Limitations and Challenges 197
7.4 Recommendations 198
7.5 Implementation Plan 199

References 202
Appendix A. LIST OF ACRONYMS 205
Appendix B. MANUAL COUNT METHOD 207
Appendix C. ROAD ATTRIBUTES/CYCLISTS SUMMARY SHEET 209
Appendix D. DATA EVALUATION GRAPHICS 211
Appendix E. DATA EVALUATION TABLES 224

LIST OF TABLES

Table 3-1: UDOT Internal Survey Familiarity Question One Results 28

Table 5-1: Davis County Sites 68

Table 5-2: AM Bicycle Counts for 1700 South at 1518 West, Syracuse 71

Table 5-3: Noon Bicycle Counts for 1700 South at 1518 West, Syracuse 71

Table 5-4: PM Bicycle Counts for 1700 South at 1518 West, Syracuse 71

Table 5-5: AM Bicycle Counts for 2700 South at 1518 West, Syracuse 73

Table 5-6: Noon Bicycle Counts for 2700 South at 1518 West, Syracuse 73

Table 5-7: PM Bicycle Counts for 2700 South at 1518 West, Syracuse 73

Table 5-8: Salt Lake County Sites 73

Table 5-9: AM Bicycle Counts for Main Street at 550 South, Salt Lake City 76

Table 5-10: Noon Bicycle Counts for Main Street at 550 South, Salt Lake City 76

Table 5-11: PM Bicycle Counts for Main Street at 550 South, Salt Lake City 77

Table 5-12: AM Bicycle Counts for 500 East at 750 South, Salt Lake City 78

Table 5-13: Noon Bicycle Counts for 500 East at 750 South, Salt Lake City 79

Table 5-14: PM Bicycle Counts for 500 East at 750 South, Salt Lake City 79

Table 5-15: AM Bicycle Counts for 600 East at 550 South, Salt Lake City 80

Table 5-16: Noon Bicycle Counts for 600 East at 550 South, Salt Lake City 81

Table 5-17: PM Bicycle Counts for 600 East at 550 South, Salt Lake City 81

Table 5-18: AM Bicycle Counts for 700 East at 550 South, Salt Lake City 83

Table 5-19: Noon Bicycle Counts for 700 East at 550 South, Salt Lake City 83

Table 5-20: PM Bicycle Counts for 700 East at 550 South, Salt Lake City 83

Table 5-21: AM Bicycle Counts for 700 East at 9662 South, Sandy 85

Table 5-22: Noon Bicycle Counts for 700 East at 9662 South, Sandy 85

Table 5-23: PM Bicycle Counts for 700 East at 9662 South, Sandy 85

Table 5-24: AM Bicycle Counts for State Street at 9662 South, Sandy 87

Table 5-25: Noon Bicycle Counts for State Street at 9662 South, Sandy 87

Table 5-26: PM Bicycle Counts for State Street at 9662 South, Sandy 87

Table 5-27: AM Bicycle Counts for 10600 South at 1450 West, South Jordan 89

Table 5-28: Noon Bicycle Counts for 10600 South at 1450 West, South Jordan 89

Table 5-29: PM Bicycle Counts for 10600 South at 1450 West, South Jordan 89

Table 5-30: AM Bicycle Counts for 11400 South at 1250 West, South Jordan 92

Table 5-31: Noon Bicycle Counts for 11400 South at 1250 West, South Jordan 92

Table 5-32: PM Bicycle Counts for 11400 South 1250 West, South Jordan 92

Table 5-33: Utah County Sites 93

Table 5-34: AM Bicycle Counts for 800 North at 480 West, Orem 96

Table 5-35: Noon Bicycle Counts for 800 North at 480 West, Orem 96

Table 5-36: PM Bicycle Counts for 800 North at 480 West, Orem 96

Table 5-37: AM Bicycle Counts for 400 North at 350 West, Orem 98

Table 5-38: Noon Bicycle Counts for 400 North at 350 West, Orem 98

Table 5-39: PM Bicycle Counts for 400 North at 350 West, Orem 98

Table 5-40: AM Bicycle Counts for 800 South at 482 West, Orem 100

Table 5-41: Noon Bicycle Counts for 800 South at 482 West, Orem 101

Table 5-42: PM Bicycle Counts for 800 South at 482 West, Orem 101

Table 5-43: AM Bicycle Counts for 400 South at 482 West, Orem 102

Table 5-44: Noon Bicycle Counts for 400 South at 482 West, Orem 103

Table 5-45: PM Bicycle Counts for 400 South at 482 West, Orem 103

Table 5-46: AM Bicycle Counts for Orem Boulevard at 250 North, Orem 105

Table 5-47: Noon Bicycle Counts for Orem Boulevard at 250 North, Orem 105

Table 5-48: PM Bicycle Counts for Orem Boulevard at 250 North, Orem 105

Table 5-49: AM Weekend Bicycle Counts for Orem Boulevard at 250 North, Orem 106
Table 5-50: Noon Weekend Counts for Orem Boulevard at 250 North, Orem 106
Table 5-51: PM Weekend Counts for Orem Boulevard at 250 North, Orem 106
Table 5-52: AM Bicycle Counts for 400 West at 250 North, Orem 108
Table 5-53: Noon Bicycle Counts for 400 West at 250 North, Orem 108
Table 5-54: PM Bicycle Counts for 400 West at 250 North, Orem 108
Table 5-55: AM Bicycle Counts for University Avenue at Marrcrest East, Provo 109
Table 5-56: Noon Bicycle Counts for University Avenue at Marrcrest East, Provo................. 110
Table 5-57: PM Bicycle Counts for University Avenue at Marrcrest East, Provo..................... 110
Table 5-58: AM Bicycle Counts for North Canyon Road at 2850 North, Provo 111
Table 5-59: Noon Bicycle Counts for North Canyon Road at 2850 North, Provo..................... 112
Table 5-60: PM Bicycle Counts for North Canyon Road at 2850 North, Provo........................ 112
Table 5-61: AM Bicycle Counts for Provo River Trail at 1720 North, Provo 113
Table 5-62: Noon Bicycle Counts for Provo River Trail at 1720 North, Provo........................ 113
Table 5-63: PM Bicycle Counts for Provo River Trail at 1720 North, Provo........................... 114
Table 5-64: AM Bicycle Counts for Freedom Boulevard at 1720 North, Provo....................... 115
Table 5-65: Noon Bicycle Counts for Freedom Boulevard at 1720 North, Provo 115
Table 5-66: PM Bicycle Counts for Freedom Boulevard at 1720 North, Provo 116
Table 5-67: AM Bicycle Counts for 800 North at 400 West, Provo 118
Table 5-68: Noon Bicycle Counts for 800 North at 400 West, Provo....................................... 118
Table 5-69: PM Bicycle Counts for 800 North at 400 West, Provo.. 118
Table 5-70: AM Bicycle Counts for 500 North at 400 West, Provo 120
Table 5-71: Noon Bicycle Counts for 500 North at 400 West, Provo....................................... 120
Table 5-72: PM Bicycle Counts for 500 North at 400 West, Provo.. 120
Table 5-73: AM Bicycle Counts for Freedom Boulevard at 650 North, Provo......................... 122

Table 5-74: Noon Bicycle Counts for Freedom Boulevard at 650 North, Provo 122

Table 5-75: PM Bicycle Counts for Freedom Boulevard at 650 North, Provo 122

Table 5-76: AM Bicycle Counts for 500 West at 650 North, Provo 123

Table 5-77: Noon Bicycle Counts for 500 West at 650 North, Provo....................................... 124

Table 5-78: PM Bicyle Counts for 500 West at 650 North, Provo.. 124

Table 5-79: AM Bicycle Counts for Freedom Boulevard at 450 South, Provo.......................... 125

Table 5-80: Noon Bicycle Counts for Freedom Boulevard at 450 South, Provo 126

Table 5-81: PM Bicycle Counts for Freedom Boulevard at 450 South, Provo 126

Table 5-82: AM Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo.......... 126

Table 5-83: Noon Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo 126

Table 5-84: PM Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo 127

Table 5-85: AM Bicycle Counts for 500 West at 450 South, Provo 128

Table 5-86: Noon Bicycle Counts for 500 West at 450 South, Provo....................................... 128

Table 5-87: PM Bicycle Counts for 500 West at 450 South, Provo.. 128

Table 5-88: AM Bicycle Counts for Center Street at 350 East, Provo 130

Table 5-89: Noon Bicycle Counts for Center Street at 350 East, Provo.................................... 130

Table 5-90: PM Bicycle Counts for Center Street at 350 East, Provo....................................... 130

Table 5-91: AM Weekend Bicycle Counts for Center Street at 350 East, Provo 131

Table 5-92: Noon Weekend Bicycle Counts for Center Street at 350 East, Provo 131

Table 5-93: PM Weekend Bicycle Counts for Center Street at 350 East, Provo....................... 131

Table 5-94: AM Bicycle Counts for 300 South at 330 East, Provo... 133

Table 5-95: Noon Bicycle Counts for 300 South at 330 East, Provo 133

Table 5-96: PM Bicycle Counts for 300 South at 330 East, Provo 133

Table 5-97: AM Bicycle Counts for 200 East at 450 North, Provo... 135

Table 5-98: Noon Bicycle Counts for 200 East at 450 North, Provo 135

Table 5-99: PM Bicycle Counts for 200 East at 450 North, Provo 135

Table 5-100: AM Bicycle Counts for 100 East at 450 North, Provo... 136

Table 5-101: Noon Bicycle Counts for 100 East at 450 North, Provo 137

Table 5-102: PM Bicycle Counts for 100 East at 450 North, Provo 137

Table 5-103: AM Bicycle Counts for Center Street at 300 East, Springville............................ 138

Table 5-104: Noon Bicycle Counts for Center Street at 300 East, Springville 139

Table 5-105: PM Bicycle Counts for Center Street at 300 East, Springville 139

Table 5-106: AM Bicycle Counts for 100 South at 300 East, Springville 140

Table 5-107: Noon Bicycle Counts for 100 South at 300 East, Springville.............................. 141

Table 5-108: PM Bicycle Counts for 100 South at 300 East, Springville................................. 141

Table 5-109: Washington County Sites 141

Table 5-110: AM Bicycle Counts for 700 East at 150 South, St. George 144

Table 5-111: Noon Bicycle Counts for 700 East at 150 South, St. George............................... 144

Table 5-112: PM Bicycle Counts for 700 East at 150 South, St. George.................................. 144

Table 5-113: AM Bicycle Counts for 600 East at 150 South, St. George 145

Table 5-114: Noon Bicycle Counts for 600 East at 150 South, St. George............................... 146

Table 5-115: PM Bicycle Counts for 600 East at 150 South, St. George.................................. 146

Table 5-116: AM Bicycle Counts for 400 East at 350 South, St. George 147

Table 5-117: Noon Bicycle Counts for 400 East at 350 South, St. George............................... 148

Table 5-118: PM Bicycle Counts for 400 East at 350 South, St. George.................................. 148

Table 5-119: AM Bicycle Counts for 300 South at 650 East, St. George 149

Table 5-120: Noon Bicycle Counts for 300 South at 650 East, St. George............................... 149

Table 5-121: PM Bicycle Counts for 300 South at 650 East, St. George.................................. 150

Table 5-122: AM Bicycle Counts for 400 South at 650 East, St. George 151

Table 5-123: Noon Bicycle Counts for 400 South at 650 East, St. George............................... 151

Table 5-124: PM Bicycle Counts for 400 South at 650 East, St. George 151

Table 5-125: Weber County Sites 152

Table 5-126: AM Bicycle Counts for Grant Avenue at 2125 South, Ogden 154

Table 5-127: Noon Bicycle Counts for Grant Avenue at 2125 South, Ogden 154

Table 5-128: PM Bicycle Counts for Grant Avenue at 2125 South, Ogden.............................. 154

Table 5-129: AM Bicycle Counts for Lincoln Avenue at 2125 South, Ogden........................... 156

Table 5-130: Noon Bicycle Counts for Lincoln Avenue at 2125 South, Ogden 156

Table 5-131: PM Bicycle Counts for Lincoln Avenue at 2125 South, Ogden 156

Table 5-132: AM Bicycle Counts for Grant Avenue at 2550 South, Ogden 158

Table 5-133: Noon Bicycle Counts for Grant Avenue at 2550 South, Ogden 158

Table 5-134: PM Bicycle Counts for Grant Avenue at 2550 South, Ogden.............................. 158

Table 5-135: AM Bicycle Counts for Lincoln Avenue at 2550 South, Ogden........................... 159

Table 5-136: Noon Bicycle Counts for Lincoln Avenue at 2550 South, Ogden 160

Table 5-137: PM Bicycle Counts for Lincoln Avenue at 2550 South, Ogden 160

Table 6-1: Statistical Results of Noon Bicycle Rate Compared to AADT for All Sites 164

Table 6-2: Statistical Results of Noon Bicycle Rates Compared to AADT for Roadways With Bicycle Infrastructure 165

Table 6-3: Statistical Results of Noon Bicycle Rates Compared to AADT for Roadway Without Infrastructure 167

Table 6-4: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for All Sites 169

Table 6-5: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for Sites with Bicycle Infrastructure 171

Table 6-6: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for Sites Without Bicycle Infrastructure 172

Table 6-7: Statistical Results of Noon Bicycle Rates Compared to Number of Lanes for All Sites 174

Table 6-8: Statistical Results of Noon Bicycle Rates compared to Number of Lanes for Sites with Bicycle Infrastructure 175

Table 6-9: Statistical Results of Noon Bicycle Rates Compared to Number of Lanes for Sites Without Bicycle Infrastructure 177

Table 6-10: Statistical Results of Noon Bicycle Rates Compared to Roadway Classification for All Sites 179

Table 6-11: Statistical Results of Noon Bicycle Rates Compared to Roadway Classification for Sites With Bicycle Infrastructure 180

Table 6-12: Statistical Results of Noon Bicycle Rates Compared to Road Classification for Sites Without Bicycle Infrastructure 182

Table 6-13: Results of the Least Square Means 183

Table 6-14: Results of the Mixed Model ANOVA 183

Table 6-15: Sites With Bicycle Infrastructure Versus Sites Without Bicycle Infrastructure Including all Counties 184

Table 6-16: Results of the Least Square Means 184

Table 6-17: Results of the Mixed Model ANOVA 184

Table 6-18: Sites With Bicycle Infrastructure Versus Sites Without Bicycle Infrastructure Excluding Washington County 185

LIST OF FIGURES

Figure 2-1: Shared lane (no special provisions) 17

Figure 2-2: Shared lanes (wide outside lanes) 18

Figure 2-3: Marked shared lanes........ 19

Figure 2-4: Paved shoulder 20

Figure 2-5: Bike lanes........ 21

Figure 2-6: Bicycle boulevards........ 22

Figure 2-7: Shared use path (independent right-of-way)........ 23

Figure 2-8: Shared use path (adjacent to roadways)........ 24

Figure 3-1: Utah household survey participant age. 34

Figure 3-2: Utah household survey participant county code. 34

Figure 3-3: General frequency of bicycle ridership. 35

Figure 3-4: Bicycle ridership frequency by age........ 36

Figure 3-5: Bicycle ridership frequency by gender. 36

Figure 3-6: Bicycle ridership frequency by employment status. 37

Figure 3-7: Frequency by location of residence. 37

Figure 3-8: Reasons for not bicycling........ 39

Figure 3-9: Reasons for not bicycling by age. 40

Figure 3-10: Reasons for not bicycling by gender........ 41

Figure 3-11: Reasons for not bicycling by employment status........ 42

Figure 3-12: Reaons for not bicycling by locations of residence. 43

Figure 3-13: General purpose for bicycling........ 46

Figure 3-14: General reasons for bicycling. 47

Figure 3-15: Purpose for bicyling by age. 48

Figure 3-16: Purpose for bicycling by gender. 49

Figure 3-17: Purpose for bicycling by employment status. 50

Figure 3-18: Purpose for bicycling by location of residence. 51

Figure 3-19: How strongly do you agree? 52

Figure 3-20: Agreement based on frequency. 53

Figure 4-1: Equipment used for automatic counting method. 57

Figure 4-2: Placement of the first mini tube 59

Figure 4-3: Seperation of first and second mini tube 59

Figure 4-4: Placement of remaining mini tubes 60

Figure 4-5: View of the Trax Cycles Plus unit 61

Figure 4-6: Placement of Trax Cycles Plus unit 61

Figure 4-7: Placement of mini tubes 62

Figure 4-8: Commuting cyclists wearing business attire 63

Figure 4-9: Commuting cyclist wearing casual attire with groceries 64

Figure 4-10: Commuting cyclist wearing spandex but wearing backpack 64

Figure 4-11: Recreational cyclists 65

Figure 4-12: Recreational cyclists wearing spandex 65

Figure 5-1: Location of Davis, Salt Lake, Utah, Washington, and Weber Counties. 67

Figure 5-2: Davis County site locations 68

Figure 5-3: View of 1700 South at 1518 West, Syracuse. 69

Figure 5-4: Westbound view of the bike lane on 1700 South, Syracuse 70

Figure 5-5: View of 2700 South at 1518 West, Syracuse 72

Figure 5-6: Salt Lake County site locations. 74

Figure 5-7: View of Main Street at 550 South, Salt Lake City 75

Figure 5-8: Southbound view of the marked shared lane on Main Street at 550 South, Salt Lake City 76

Figure 5-9: Southbound view of the shared lane (no special provisions) on 500 East at 750 South, Salt Lake City 78

Figure 5-10: Southbound view of bicycle boulevard at 600 East at 550 South, Salt Lake City 80

Figure 5-11: View of 700 East at 550 South, Salt Lake City. 82

Figure 5-12: Southbound view of the paved shoulder at 700 East at 550 South, Salt Lake City 82

Figure 5-13: Southbound view of bike lane on 700 East at 9662 South, Sandy 84

Figure 5-14: View of State Street at 9662 South, Sandy 86

Figure 5-15: View of 10600 South at 1450 West, South Jordan 88

Figure 5-16: Westbound view of the bike lane on 10600 South at 1450 West, South Jordan. 89

Figure 5-17: View of 11400 South at 1250 West, South Jordan 91

Figure 5-18: Westbound view of the bike lane on 11400 South at 1250 West, South Jordan 91

Figure 5-19: Utah County site locations. 94

Figure 5-20:View of 800 North at 480 West, Orem 95

Figure 5-21: Eastbound view of shared use path on 800 North at 480 West, Orem 96

Figure 5-22: View of 400 North at 350 West, Orem. 97

Figure 5-23: View of 800 South at 482 West, Orem 99

Figure 5-24: Westbound view of the bike lane on 800 South at 482 West, Orem 100

Figure 5-25: View of 400 South at 482 West, Orem. 102

Figure 5-26: View of Orem Boulevard at 250 North, Orem 104

Figure 5-27: Northbound view of the bike lane on Orem Boulevard at 250 North, Orem. 105

Figure 5-28: View of 400 West at 250 North, Orem 107

Figure 5-29: Soutbound view of the shared use path on University Avenue at Marrcrest East, Provo 109

Figure 5-30: View of North Canyon Road at 2850 North, Provo 111

Figure 5-31: Southbound view of the Provo River Trail at 1720 North, Provo 113

Figure 5-32: View of Freedom Boulevard at 1720 North, Provo 115

Figure 5-33: View of 800 North at 400 West, Provo... 117

Figure 5-34: Eastbound view of the bike lane on 800 North at 400 West, Provo. 117

Figure 5-35: View of 500 North at 400 West, Provo... 119

Figure 5-36: View of Freedom Boulevard at 650 North, Provo 121

Figure 5-37: View of 500 West at 650 North, Provo... 123

Figure 5-38: View of Freedom Boulevard at 450 South, Provo. 125

Figure 5-39: View of 500 West at 450 South, Provo... 128

Figure 5-40: View of Center Street at 350 East, Provo 129

Figure 5-41: View of 300 South at 330 East, Provo 132

Figure 5-42: View of 200 East at 450 North, Provo 134

Figure 5-43: View of 100 East at 450 North, Provo 136

Figure 5-44: View of Center Street at 300 East, Springville 138

Figure 5-45: View of 100 South at 300 East, Springville... 140

Figure 5-46: Washington County site locations... 142

Figure 5-47: View of 700 East at 150 South, St. George 143

Figure 5-48: View of 600 East at 150 South, St. George 145

Figure 5-49: View of 400 East at 350 South, St. George 147

Figure 5-50: View of 300 South at 650 East, St. George 149

Figure 5-51: View of 400 South at 650 East, St. George 151

Figure 5-52: Weber County site locations. 152

Figure 5-53: View of Grant Ave at 2125 South, Ogden. 153

Figure 5-54: View of Lincoln Ave at 2125 South, Ogden.. 155

Figure 5-55: View of Grant Ave at 2550 South, Ogden. 157

Figure 5-56: View of Lincoln Ave at 2550 South, Ogden.. 159

Figure 6-1: Noon bicycle rates compared to AADT for all sites. 163

Figure 6-2: Noon bicycle rates compared to AADT for sites with bicycle infrastructure.......... 165

Figure 6-3: Noon bicycle rates compared to AADT for sites without bicycle infrastructure..... 167

Figure 6-4: Noon bicycle rates compared to posted speed limits for all sites. 169

Figure 6-5: Noon bicycle rates compared to posted speed limit for sites with bicycle infrastructure. 170

Figure 6-6: Noon bicycle rates compared to posted speed for sites without bicycle infrastructure. 172

Figure 6-7: Noon bicycle rates compared to number of lanes for all sites. 174

Figure 6-8: Noon bicycle rates compared to number of lanes for sites with bicycle infrastructure. 175

Figure 6-9: Noon bicycle rates compared to number of lanes for sites without bicycle infrastructure. 176

Figure 6-10: Noon bicycle rates compared to roadway classifications for all sites................... 178

Figure 6-11: Noon bicycle rates compared to roadway classification for sites with bicycle infrastructure. 180

Figure 6-12: Noon bicycle rates compared to road classification for non-bicycle infrastructure roads. 181

Figure 6-13: College Connector Trail volumes. 186

Figure 6-14: Provo River Trail volumes. 187

Figure 6-15: Murdock Canal Trail volumes. 188

1 INTRODUCTION

Bicycling as an alternate mode of transportation has been on the rise. It is environmentally friendly in nature and the associated health benefits have made it a popular choice for many types of trips. With vehicle trips being replaced by bicycle trips, transportation planning should safely accommodate bicyclists while minimizing the impact on vehicle access. With the implementation of the Utah Department of Transportation (UDOT) *Inclusion of Active Transportation* policy, information on type and level of impact has become more important. The purpose of this research was to increase understanding of the impacts of implementing bicycle corridors (as part of UDOT's *Inclusion of Active Transportation* policy) on bicycle rate as a function of roadway characteristics. The results of this research will be used in determining when and where bicycle corridors will enhance the transportation system and an estimate of the overall impact of bicycle corridors on travel demand in Utah.

1.1 Objectives

The primary objective of this research was to increase understanding of the impacts of implementing bicycle corridors within the State Route system on bicycle rate as a function of roadway characteristics. This was accomplished by:

1. Evaluating the impact of the UDOT *Inclusion of Active Transportation* policy in the state.

2. Estimating the impact of bicycle corridors on bicycle rate as a function of roadway characteristics.
3. Evaluating the impact of bicycle corridors in combination with vehicle lanes.
4. Providing guidelines to be used when evaluating locations for possible bicycle corridors or bikeways.
5. Providing empirical evidence on the impact of bicycle corridors across the nation.

It is anticipated that this will continue to be an ongoing effort. Future phases of the research will be developed to collect additional data that will aid in better defining issues associated with the research.

1.2 Scope

This research included four primary tasks: conduct a literature review, evaluate data on active transportation in Utah, evaluate segments with and without bicycle corridors, and provide a final report and presentation with recommendations from the research.

The purpose of the literature review was to train and inform new research assistants regarding the topics of active transportation and bicycle corridors, and to address specific topics in the research including, but not limited to: 1) active transportation policies across the nation; 2) bicycle implementation plans; 3) impact of bicycle corridors on bicycle and vehicle mode split; 4) impact of bicycle corridors on vehicle lanes; and 5) planning and constructing bicycle corridors. One of the research byproducts is the transfer of knowledge and information to help develop the next generation of transportation engineers and planners. This task is critical in the ongoing workforce development process.

The second primary task was to evaluate data on active transportation where active transportation is defined by UDOT in the *Inclusion of Active Transportation* policy (UDOT 07-117) as "…multimodal transportation solutions that connect people to the places and services they need or desire access to. Included but not limited are work, school, business, government facilities, transit, recreation and community centers, health care, and other services that are essential to their livelihood and wellbeing, using 'active' or non-motorized modes such as walking or bicycling" (UDOT 2006).

The third primary task for this project was to evaluate State Route segments with and without bicycle corridors to empirically quantify the impact of bicycle infrastructure on rate and determine whether the results yield any guidelines for future bicycle corridor implementation. The first step of this task was to identify bicycle corridors for analysis. Based on the input of the Technical Advisory Committee (TAC), bicycle corridors were defined as roadways where bicycle facilities have been implemented for a minimum distance of 1 mile (8 blocks). Roadway characteristics such as roadway classification, urban code, and annual average daily traffic (AADT) were documented for each site. The corridors were representative of the state and included locations in Weber, Davis, Salt Lake, Utah, and Washington Counties.

The final primary task of the project was to provide recommendations and conclusions along with a final report and presentation, based upon observations and analysis in each of the previous tasks.

1.3 Outline of Thesis

This thesis contains the following seven chapters: 1) Introduction, 2) Literature Review, 3) Review of the Active Transportation Policy, 4) Research Methods, 5) Data Collection, 6) Data Evaluation, and 7) Conclusions and Recommendations. Chapter 1 briefly presents the problem statement, objectives, and work scope. Chapter 2 provides a literature review, including insight into the subject of active transportation with a particular focus on bicycle as a mode of transportation. Chapter 3 provides insight into the mindset of UDOT employees in regards to the *Inclusion of Active Transportation* policy and presents results of the Utah Statewide Household Travel Survey. Chapter 4 provides details of the two primary methods for collecting data adopted for the study along with the equipment and procedures used to collect bicycle data. Chapter 5 provides details on the data collection sites and the data collection process. Chapter 6 provides the data collected at each site. Collected data were evaluated using statistical methods and tested to determine trends. Chapter 7 explains the findings of the study, limitations that hindered specific aspects to the project, and recommendations to UDOT based on the research.

Four appendices were included in this thesis: A) Manual Count Method, B) Road Attributes/Cyclists Summary Sheet, C) Data Evaluation Graphics, and D) Data Evaluation Tables. Appendix B contains the worksheet used to collect bicycle data manually. Appendix C contains the summarized raw data collected and the attributes of the roads for each site. Appendix D shows graphs for the AM and PM analysis that were not included in the main body of the thesis. Lastly, Appendix E shows tables for the AM and PM analysis that were not included in the main body of the thesis.

2 LITERATURE REVIEW

2.1 Overview

Several sources were analyzed to provide education on topics related to bicycle corridors in Utah and across the nation. To gain a better understanding of active transportation nationally, active transportation policies for several different Departments of Transportation (DOTs) were reviewed. Bicycle implementation plans were then reviewed for several cities. After an evaluation of policies, a review of the impacts of bicycle corridors on bicycle and vehicle mode split was conducted. Impacts of bicycle corridors in combination with vehicle lanes were reviewed to provide a clearer picture of the different effects of bicycle corridors. Mode split impacts were then followed up with a review of bicycle infrastructure. Finally, a discussion on evaluating and installing bicycle corridor alternatives is provided.

2.2 Active Transportation Policies

The first active transportation policy reviewed was the one signed by the United States Department of Transportation (USDOT) on March 11, 2010 (USDOT 2010), which states:

> "The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes" (USDOT 2010).

As outlined by the USDOT active transportation policy, transportation agencies are responsible for providing improved conditions and opportunities for individuals to walk or bike to their various destinations. With this in mind, several state DOT active transportation policies were reviewed including policies for UDOT, the Colorado Department of Transportation (CDOT), the Minnesota Department of Transportation (MnDOT), the Washington State Department of Transportation (WSDOT), and the Oregon Department of Transportation (ODOT).

2.2.1 Utah Active Transportation Policy

UDOT has interest in active transportation and as a result has established an active transportation policy. The policy, which became effective on May 18, 2006 (UDOT 2006), states:

> "It is the policy of the Department that the needs of bicyclists, pedestrians, and other Active Transportation users will be routinely considered as an important aspect in the funding, planning, design, construction, operation, and maintenance of Department transportation facilities.
>
> "This policy applies statewide, to facilities in urban, suburban, and rural settings. All transportation activities that are funded by or through Department and planned, designed, constructed, or maintained on state facilities will adhere to this policy" (UDOT 2006).

2.2.2 Colorado Active Transportation Policy

The active transportation policy for CDOT was reviewed due to the success of the department in implementing active transportation. The policy, established on October 22, 2009 (CDOT 2009), states:

> "It is the policy of the Colorado Transportation Commission to provide transportation infrastructure that accommodates bicycle and pedestrian use of the highways in a manner that is safe and reliable for all highway users. The needs of bicyclists and pedestrians shall be included in the planning, design, and operation of transportation facilities, as a matter of routine. A decision to not accommodate them shall be documented based on the exemption criteria in the procedural directive" (CDOT 2009).

2.2.3 Minnesota Active Transportation Policy

MnDOT has included active transportation in the Minnesota Statutes (MnDOT 2014). The MnDOT Active Transportation Policy states:

> "To promote and increase bicycling as an energy-efficient, non-polluting and healthful transportation alternate. Provide safe transportation to users throughout the state. Provide multi modal and inter-modal transportation that enhances mobility, economic development, and provides access to all persons. Increase transit use in the urban areas by giving highest priority to the transportation modes with the greatest people moving capacity. Ensure that the planning and implementation of all modes of transportation are consistent with the environment and energy goals of the state" (MnDOT 2014).

MnDOT is strongly encouraging a complete streets philosophy and strives to accommodate active transportation users throughout the state. This has been done by implementing the active transportation policy along with a statewide bicycle system plan.

2.2.4 Washington State Active Transportation Policy

WSDOT has established and encouraged active transportation through their active transportation policies. WSDOT not only has an active transportation policy but also has an outlined active transportation plan for the entire state. The WSDOT active transportation policies are very extensive and therefore will not be included in this thesis but may be found in their Milestone Report D (WSDOT 2007).

2.2.5 Oregon Active Transportation Policy

ODOT has an extensive active transportation policy and plan very similar to WSDOT thus only a brief summary of the policy and plan are discussed here. The ODOT active transportation policy has been summed up into one goal with three specific actions. The goal is to "provide safe, accessible and convenient bicycling and walking facilities and to support and encourage increased levels of bicycling and walking" (ODOT 1995). The three supporting actions to see this goal met are to "provide bikeway and walkway systems that are integrated with other transportation environments;" to "create a safe, convenient and attractive bicycling and walking environment;" and to "develop education programs that improve bicycle and pedestrian safety" (ODOT 1995). All of these actions have been successfully initiated and have thus provided a prosperous active transportation system in the state of Oregon.

2.3 Bicycle Implementation Plans

Several city and county bicycle implementation plans, goals, missions, and visions were evaluated to determine what actions have been taken to encourage the implementation of active transportation programs. The following sections provide detail of some of the bicycle implementation plans in several cities and counties in Utah, Colorado, Washington, and Oregon.

2.3.1 Salt Lake County, UT

Salt Lake County has established a mission statement to increase active transportation in the 17 cities within the county. Salt Lake County's mission is to "provide safe, convenient and feasible active transportation in Salt Lake County for all abilities through encouragement, collaboration, and education" (SLCo 2015a). The mission includes four actions that will be used to ensure success:

1. Implement a pedestrian and Bike Transportation Improvement Program (BTIP) for the unincorporated county communities that is accessible to all.
2. Coordinate planning and implementation of active transportation facilities and programs with agencies and adjoining communities.

3. Implement the County complete street policy in unincorporated areas of the county, while actively searching for opportunities to further improve active transportation.
4. Advocate and provide technical resources to further support self-reliance of the traveling public for active transportation including; the Salt Lake County Bicycle Advisory Committee, County residence, Salt Lake County Bicycle Ambassador Program, Safe Routes To School, and other related programs.

The Salt Lake County Bicycle Ambassador Program was established to assist with the general mission as outlined previously. The mission statement for this program states (SLCo 2015b):

> "To build a team of enthusiastic, outgoing, and informed bicycle commuters to educate residents, promote bicycle travel, improve bicycle travel conditions, and foster a culture of shared-use and mutual respect between bicycles and other roadway users in Salt Lake County" (SLCo 2015b).

Three goals and objectives were established for the program: "increase bicycling participation and safety, reward safe bicycling and driving, and foster an engaged community of citizen bicyclists (SLCo 2015b). An easy online signup was established to provide more opportunities for people to join the program.

2.3.2 Salt Lake City, UT

Salt Lake City established a bicycle and pedestrian master plan in September of 2004. The plan provides five goals (SLC 2004):

1. To incorporate bicycle and pedestrian mobility and facility needs into community planning, land use planning and the development process.

2. To expand the existing pedestrian and bicycle system and improve on-street bicycle travel between neighborhoods, within the City, and to connecting intra-city locations.
3. To improve the quality of the existing system.
4. To promote safe bicycling and enhance pedestrian safety.
5. To maximize the use of available federal and state funding opportunities to support pedestrian and bicycle programs and facilities development.

Along with each goal, several actions have been set in place to provide a well-functioning system. More detail on the actions can be found in the master plan document (SLC 2004).

2.3.3 Provo, UT

In 2013, the City of Provo established a bicycle master plan to provide adequate bicycle opportunities to residents. Based on input from the Steering Committee, eight categories of goals were established for Provo (2013):

1. Complete streets: Accommodate bicyclists within the public right-of-way.
2. Implementation: Equip city staff/stakeholders with the necessary tools to implement the bicycle master plan.
3. Bikeway Network: Provide a complete bikeway network throughout the city of Provo.
4. Maintenance: Keep bicycle and trail facilities clean, safe, and accessible.
5. Safety: Make Provo a safe and enjoyable place to ride a bicycle.
6. Education and Encouragement: Implement comprehensive education and encouragement programs targeted at all populations in the City.

7. Education: Monitor implementation of the Provo City Bicycle Master Plan and conditions relating to bicycling in Provo.
8. Bike-Transit Integration: Improve multi-modal transportation by coordinating bicycle projects with existing and future transit plans.

Several objectives were established for each goal in order to provide success of this bicycle master plan.

2.3.4 Orem, UT

The City of Orem established a bicycle master plan diversity transportation choices throughout the city. The plan consists of a vision, goals, and objectives. The goals are as follows (Orem 2008):

1. Implement a Complete Streets Policy.
2. Complete a non-motorized transportation system network.
3. Monitor the implementation of the Orem Bicycle and Pedestrian Plan.
4. Reduce the vehicle miles traveled by single occupancy vehicles in the City of Orem.
5. Integrate bicycling and walking into the transit system.
6. Ensure citywide bicycle and pedestrian facilities are clean, safe, and accessible.
7. Implement comprehensive education and encouragement programs targeted at all populations in the city.
8. Increase enforcement of City streets and bikeways.
9. Provide safe and accessible routes for bicyclists and pedestrians of all ages and abilities.

2.3.5 Boulder, CO

The City of Boulder was able to establish a successful bicycle system plan that addresses the following four main points (Boulder 2015):

1. The City will complete a grid-based system of primary and secondary bicycle corridors to provide bicycle access to all major destinations and all parts of the community.
2. The city will coordinate with Boulder County, University of Colorado Boulder (CU), the Boulder Urban Renewal Authority (BURA), neighborhood plans, the City Parks and Recreation Department, the Open Space and Mountain Parks Department and other government entities, and plans to ensure that all city and county projects connect with and/or help to complete the corridor network.
3. The city will work with property owners, developers, the BURA, the Boulder Valley School District (BVSD), the City Parks and Recreation Department, and CU to ensure that commercial, public, and mixed-use and multi-unit residential sites provide direct, safe and convenient internal bicycle circulation oriented along the line of sight from external connections to areas near building entrances and other on-site destinations.
4. The city will combine education and enforcement efforts to help instill safe and courteous use of the shared public roadway, with a focus on better educating students on how to properly share the road with bicyclists, pedestrians and users of transit.

2.3.6 Seattle, WA

The City of Seattle has been a champion for its residents where bicycle opportunities are concerned. Their plan presents a vision, an outline of five main goals, and objectives to assist in achieving each goal. The vision states: "riding a bicycle is a comfortable and integral part of daily life in Seattle for people of all ages and abilities" (Seattle 2015). The five goals to accomplish this vision are:

1. Ridership: Increase the amount and mode share of bicycling in Seattle for all trip purposes.
2. Safety: Improve safety for bicycle riders.
3. Connectivity: Create a bicycle network that connects to places that people want to go, and provides for a time-efficient travel option.
4. Equity: Provide equal bicycling access for all through public engagement, program delivery, and capital investment.
5. Livability: Build vibrant and healthy communities by creating a welcoming environment for bicycle riding.

2.3.7 Portland, OR

The City of Portland has been referred to as "one of the country's most bicycle-friendly cities" (Portland 2015) and thus a review of its bicycle master plan was reviewed to better understand their success. Portland developed as a bicycle-minded city earlier than many other cities throughout the United States and thus has had time to improve its plan. Portland created their first bicycle plan in 1973 and it has been consistently improved over time. Five key elements of the current plan are (Portland 2015):

1. Policies and objectives that form part of Portland's Comprehensive Plan Transportation Element.
2. Developing a recommended bikeway network.

3. Providing end-of-trip facilities.

4. Improving the bicycle-transit link.

5. Promoting bicycling through education and encouragement.

In addition, their municipal policy language states (Portland 2015):

> "Make the bicycle an integral part of daily life in Portland, particularly for trips of less than five miles, by implementing a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer" (Portland 2015).

2.4 Impact of Bicycle Corridors on Bicycle and Vehicle Mode Split

The presence of dedicated bicycle infrastructure may influence some people to ride a bicycle even if they have the option to drive, particularly if that infrastructure is located along corridors that provide access to employment, shopping, and recreation.

Distance is also an important factor. If the travel distance for a person is relatively short, it is more likely for that individual to use alternate transportation options, such as walking or bicycling, in place of personal vehicles. According to the Utah Collaborative Active Transportation Study (UCATS) conducted in 2014, "half of all trips taken in the United States are three miles or less, with 40% under two miles" (Burbidge and Vyas 2014). With half of trips taken at 3 miles or less it is reasonable in thinking that many of these trips could be made on foot or by bicycle. However; UCATS reports that "90% of trips fewer than three miles are taken by car" (Burbidge and Vyas 2014). It is reasonable to assume that at least some of these trips could be made by bicycles if bicycle infrastructure is constructed within the range of distance that an individual will travel to use the associated bicycle corridor, especially when considering that "the national average trip length is 2.25 miles for a one-way bicycling trip" (Burbidge and Vyas

2014). UCATS also states that “each additional mile of bicycle lane per square mile is correlated with an approximate 1% increase in the share of bike-to-work trips” (Burbidge and Vyas 2014).

2.5 Impact of Bicycle Corridors in Combination with Vehicle Lanes

Bicycle corridors can prove to be beneficial when installed in combination with a vehicle lane. A bicycle corridor provides opportunity for individuals to use the bicycle lanes instead of driving a personal vehicle. With the increase of bicycle corridors an increase in rate can be expected as new opportunities arise. According to UCATS, “a ‘disproportionate share of bicycling occurred on streets with bicycle lanes, separate paths, or bicycle boulevards,’ indicating that bicycle specific infrastructure investments were attracting new riders” (Burbidge and Vyas 2014). The installation of bicycle corridors is anticipated to encourage more users but will also provide an economic benefit to bicycle riders. With the increase of people turning to active modes of transportation the cost of transportation decreases and provides beneficial economic results for communities. According to Burbidge and Vyas (2014): “A vast amount of research has shown that people who tend to use active transportation have lower transportation costs and have more discretionary spending, which is more likely to stay within the local economy.”

In addition to providing economic benefits to individuals and communities, the construction of bicycle corridors in combination with vehicle lanes is considerably less. This has proven true for the bicycle network in Portland. The cost to build the entire bicycle network was less than building one mile of new urban freeway (Burbidge and Vyas 2014).

2.6 Planning and Constructing Bicycle Corridors

A review of the proper methods to plan and construct bicycle corridors was prepared to provide details to the different types of infrastructure available. The subsections that cover planning and constructing bicycle corridors are: 1) infrastructure and environment of bicycle corridors, 2) bicycle operation and safety, and 3) user behavior.

2.6.1 Infrastructure and Environment of Bicycle Corridors

According to Guide for the Development of Bicycle Facilities prepared by the American Association of State Highway and Transportation Officials (AASHTO) there are eight types of bicycle infrastructure: 1) shared lanes, 2) wide outside lanes, 3) marked shared lanes, 4) paved shoulders, 5) bike lanes, 6) bicycle boulevards, 7) shared use path in an independent right-of-way, and 8) shared use path adjacent to roadways (AASHTO 2012).

2.6.1.1 Shared Lanes

Shared lanes are best used on minor roads with low volumes, where a bicyclist can share the road with no special provisions. It is expected that the motor vehicle design speed will vary based on the location, specifically whether the location is in a rural or urban area, and that the traffic volume is generally less than 1,000 vehicles per day. Shared lanes are generally used on rural roads, neighborhoods, or local roads but can be used to provide an alternative to busier highways or streets (AASHTO 2012). Figure 2-1 provides details of a shared lane with no special provisions (MMMPO 2015).

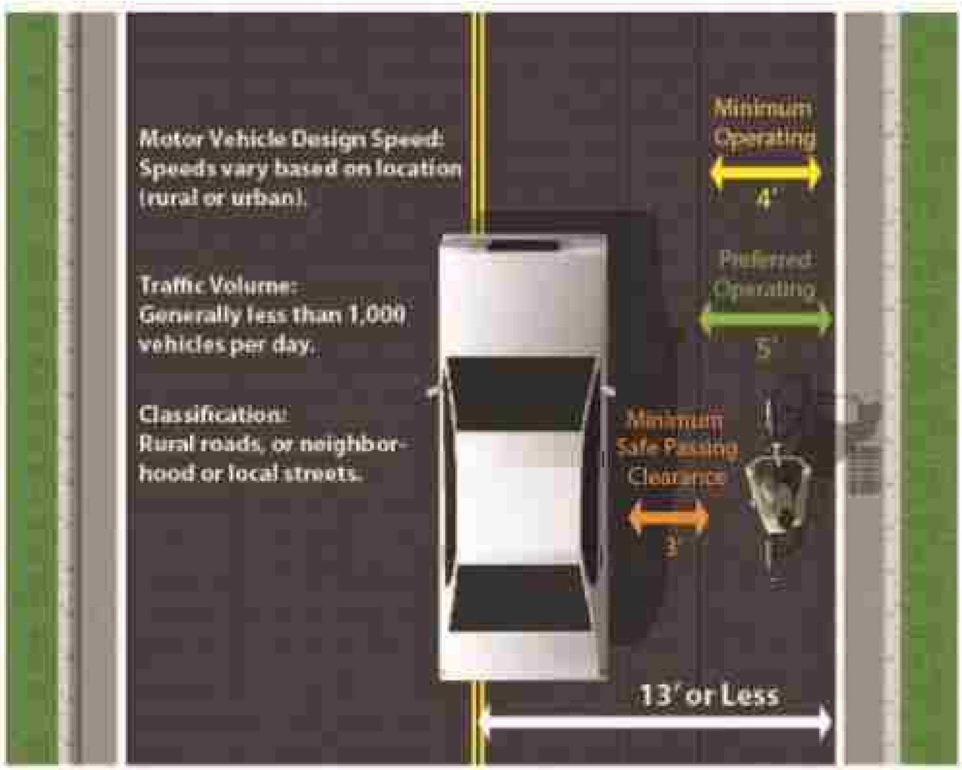

Figure 2-1: Shared lane (no special provisions) (MMMPO 2015).

2.6.1.2 Shared Lanes (Wide Outside Lanes)

Shared lanes with wide outside lanes are best used on major roads where bike lanes are not selected due to space constraints or other limitations. It is expected that the motor vehicle design speed will vary. It is best to use this treatment when the speed differential between bicyclists and motorists increases. Typically these shared lanes are used on arterials and collectors when the design speed is greater than 25 mph. They are generally used when the traffic volume is more than 3,000 vehicles per day (AASHTO 2012). Figure 2-2 provides details of a shared lane with wide outside lanes (MMMPO 2015).

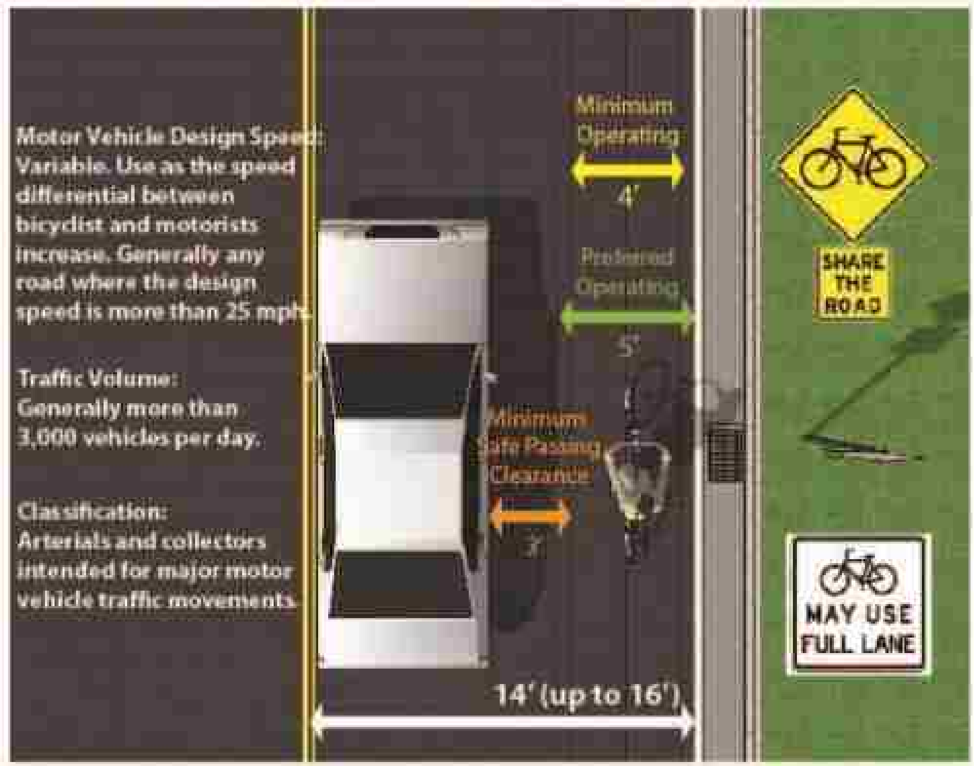

Figure 2-2: Shared lanes (wide outside lanes) (MMMPO 2015).

2.6.1.3 Marked Shared Lanes

Marked shared lanes are best used on space-constrained roads with narrow travel lanes or road segments upon which bike lanes are not selected due to space constraints or other limitations. It is expected that the motor vehicle design speed will vary but will be 35 mph or less. Marked shared lanes are generally useful where there is high turnover in on-street parking to prevent crashes with open car doors. They are most often used on roads that are classified as collectors or minor arterials (AASHTO 2012). Figure 2-3 provides details of marked shared lanes (MMMPO 2015).

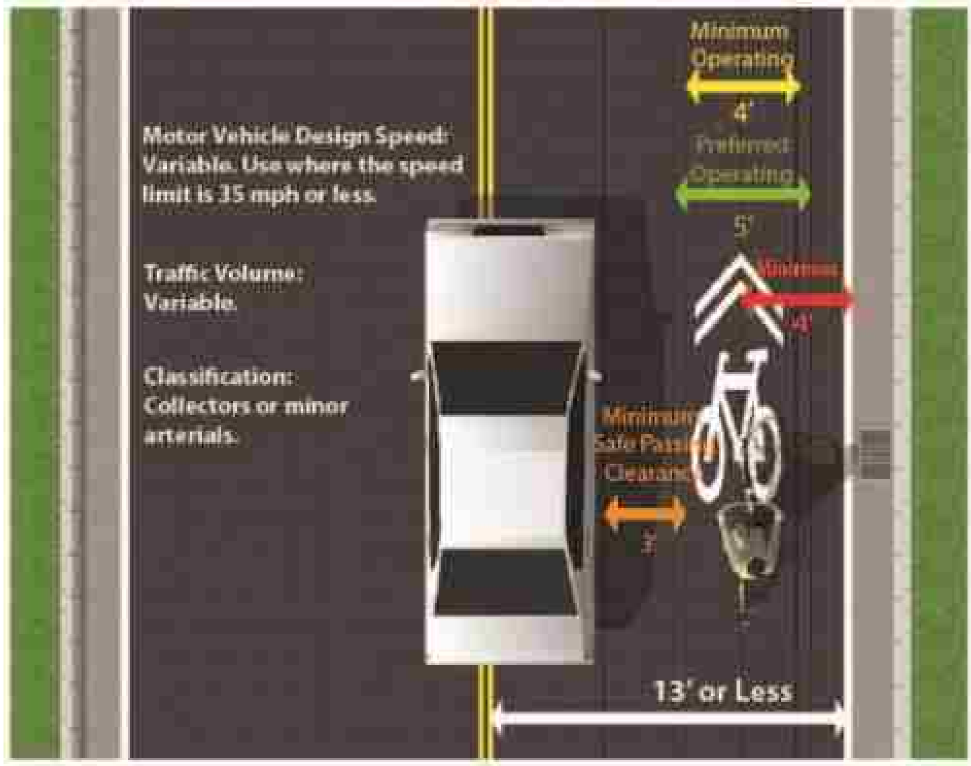

Figure 2-3: Marked shared lanes (MMMPO 2015).

2.6.1.4 Paved Shoulders

Paved shoulders are best used on rural highways that connect town centers and other major attractors. The motor vehicle design speed will generally be the typical posted rural highway speeds that range from 40 to 55 mph. Traffic volumes that are to be considered while using paved shoulders may vary and do not have a standard volume (AASHTO 2012). Figure 2-4 provides details of paved shoulders (MMMPO 2015).

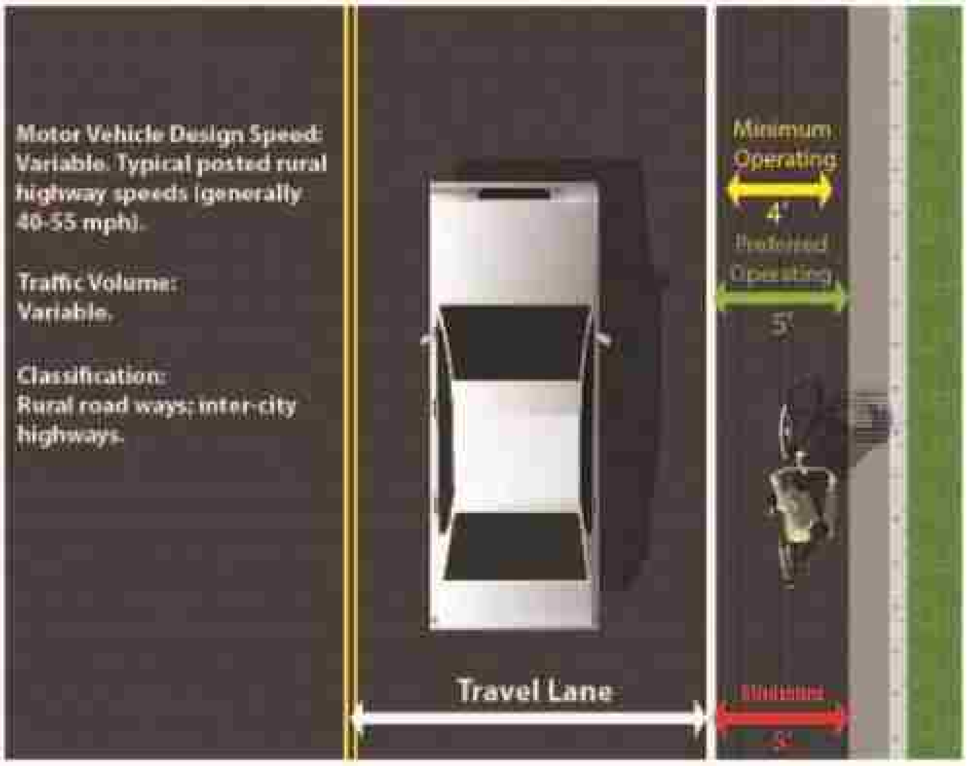

Figure 2-4: Paved shoulder (MMMPO 2015).

2.6.1.5 Bike Lanes

Bike lanes are best used on major roads that provide direct, convenient, and quick access to major land uses. The motor vehicle design speed will generally be appropriate for arterials and collectors where the design speed is more than 25 mph. However, the speed differential is generally a more important factor in the decision to provide bike lanes than traffic volumes (AASHTO 2012). Figure 2-5 provides details of bike lanes (MMMPO 2015).

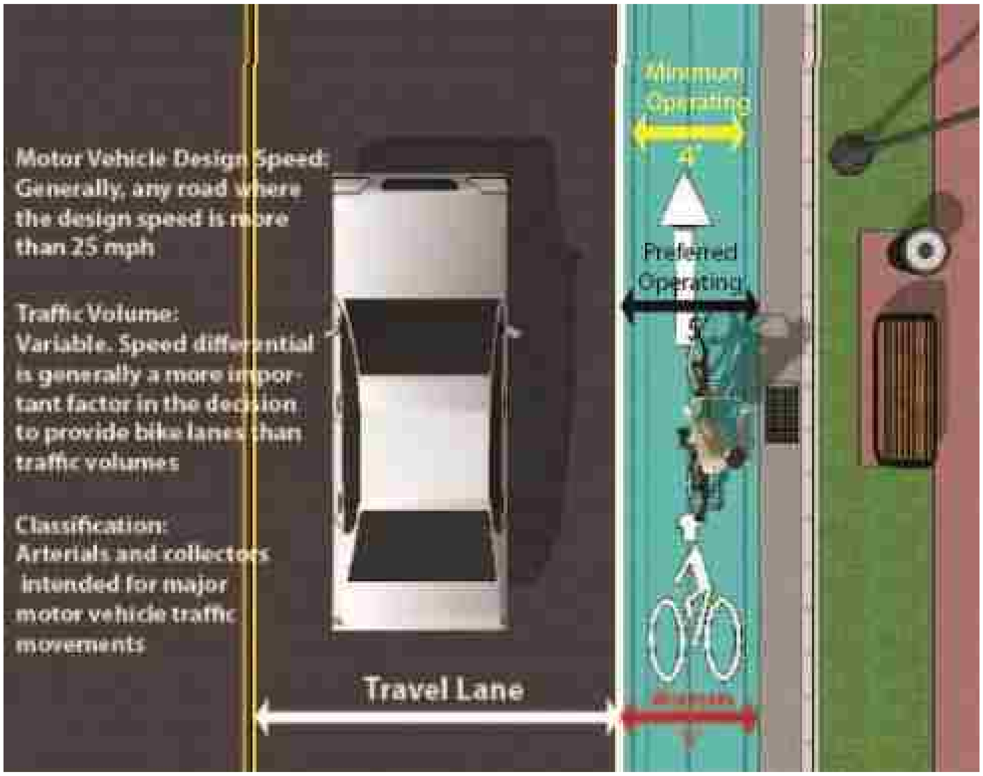

Figure 2-5: Bike lanes (MMMPO 2015).

2.6.1.6 Bicycle Boulevards

Bicycle boulevards are best used on local roads with low volumes and speeds, offering an alternative to major roads. Bicycle boulevards should still offer convenient access to land use destinations. Bicycle boulevards should be used primarily on residential roads where the speed differential between motorists and bicyclists is typically 15 mph or less, and the speed limit is generally 25 mph or less. Traffic volumes should generally be less than 3,000 vehicles per day (AASHTO 2012). Figure 2-6 provides details of bicycle boulevards (MMMPO 2015).

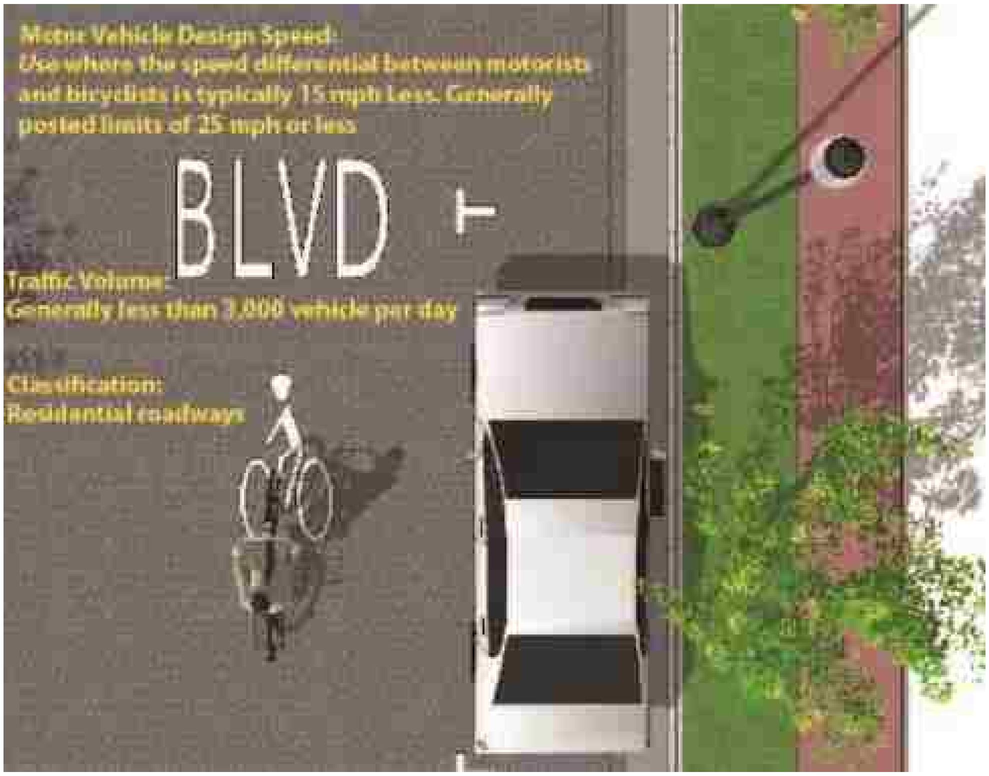

Figure 2-6: Bicycle boulevards (MMMPO 2015).

2.6.1.7 Shared Use Paths (Independent Right-of-Way)

Shared use paths are best used for linear corridors in greenways or along waterways, freeways, active or abandoned rail lines, utility rights-of-way, and/or unused rights-of-way. They may be a short connection, such as between two cul-de-sacs, or between cities. Motor vehicle design speed and traffic volumes have no effect on shared use paths within independent rights-of-way because they are separated from traffic. This type of infrastructure is intended to supplement a network of on-road bike lanes, shared lanes, bicycle boulevards, and paved shoulders (AASHTO 2012). Figure 2-7 provides details on shared use paths in independent rights-of-ways (MMMPO 2015).

Figure 2-7: Shared use path (independent right-of-way) (MMMPO 2015).

2.6.1.8 Shared Use Paths (Adjacent to Roadways)

Shared use paths adjacent to roadways are best suited to roadways with few intersections or driveways. They are typically used for a short distance to provide continuity between sections of path in independent rights-of-way. Shared use paths adjacent to roadways are intended to supplement a network of on-road bike lanes, shared lanes, bicycle boulevards, and paved shoulders. They are not intended to replace on-road accommodations for bicyclists, unless bicycle use is prohibited (AASHTO 2012). Figure 2-8 provides details of shared use path adjacent to roadways (MMMPO 2015).

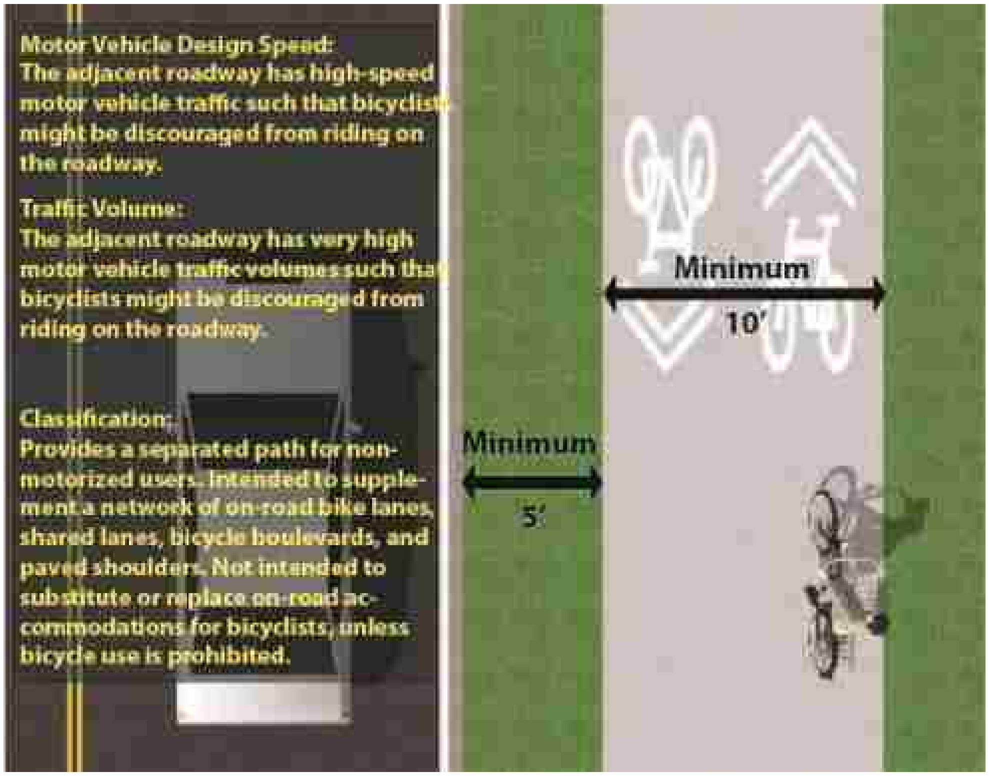

Figure 2-8: Shared use path (adjacent to roadways) (MMMPO 2015).

Using the right type of bicycle infrastructure for a given environment helps to maximize opportunities for people to bicycle for their transportation needs. When a community is prepared to provide the right environment, the use of bicycle facilities will increase. With communities built to provide adequate opportunities for bicycle users, it is likely that individuals will consider using alternate forms of travel. According to Cullen and Godson (1975), "Community design has long been proven to affect the travel decisions that people make for their daily trips." Ease of use is as important as the location and type of facility. Handy and Clifton (2001) state:

> "Many factors other than distance and travel time play a role in accessibility. For bicycling and walking, the availability of amenities and the quality of the travel environment may be just as important. Additional factors such as ease of street crossing, sidewalk continuity, local street connectively, and topography, all affect accessibility for pedestrians and should not be overlooked" (Handy and Clifton 2001).

Several factors connected to infrastructure and environment will affect the use of bicycle facilities.

2.6.2 Bicycle Operation and Safety

Bicycle infrastructure can make bicycling safer. UCATS expressed that the "more people bicycling, the lower the crash risk for bicyclers" (Burbidge and Vyas 2014) and fewer injuries due to bicycle-vehicle interaction. Building bicycle infrastructure may increase the number of people using bicycles as a means of transportation, which may decrease the number of crashes between bicycles and cars. UCATS states that "bike lanes have even been shown to reduce the general crash rate by 18% compared to streets without any bicycle facility" (Burbidge and Vyas 2014).

2.6.3 User Behavior

Many factors affect transportation mode choice. Each individual is different and will make choices different than another as "past research has proven that a variety of personal factors make one individual behave differently than another" (Golledge and Stimson 1997). Health, age, and gender are but a few factors that govern choices. With each person behaving according to their own desires and needs, many variables enter into whether a bicycle corridor will provide beneficial impact on mode choice. Goulias et al. (2004) provide insight on the factors that affect active travel behavior,

> "These include but are not limited to, the use of time and its allocation to travel and activities, the use of time in a variety of time contexts and stages in the life of people, and the organization and use of space at any level of social organization, such as the individual, the household, the community, and other formal or informal groups" (Goulias et al. 2004).

Of the many variables that affect user behavior one of the most important is the value of time. In modern society, time is valuable and bicycling generally takes longer than driving, especially if the trips are further than 2-3 miles in length. As discussed by Burbidge and Goulias (2009), “When destinations are located further apart the time required to reach those destinations increases. Choosing an active mode may not allow travel as quickly as other modes resulting in a large capability constraint.”

2.7 Chapter Summary

Active transportation can play a major part in the travel demands of Utah. The proper installation of bicycle facilities increases the active use of bicycles in communities and assists in the decrease in personal vehicle use. With the decrease of personal vehicles traffic will decrease along with vehicle mode split. Several factors affect how bicycle corridors impact mode choice including but not limited to presence of bicycle infrastructure, weather, user behavior, time, and money. Active transportation and policies have been outlined to give a foundation on the use of active transportation. Past studies have been reviewed to better understand the effects of bicycle corridors when installed with or without vehicle lanes. In summary, bicycle corridors can have positive effect on travel demands in Utah according to past studies conducted in Utah and in other states.

3 REVIEW OF THE ACTIVE TRANSPORTATION POLICY

3.1 Overview

A review of Utah's *Inclusion of Active Transportation* policy was conducted as part of the research for this project. To better understand the active transportation policy and how it is implemented it was necessary to review the two parties that are directly involved with the policy: the public and UDOT employees. Input was gathered from both parties to provide a clarification of the active transportation policy. The first part of the review was to determine UDOT employee's understanding of Utah's active transportation policy. The second part was to review the general public's view of active transportation through the household survey conducted by the Wasatch Front Regional Council (WFRC).

3.2 UDOT Internal Survey

A survey was conducted internal to UDOT to provide insight into UDOT employee's knowledge of Utah's *Inclusion of Active Transportation* policy. The questions involved in the survey are: 1) familiarity with the UDOT *Inclusion of Active Transportation* policy 2) policy requirement of Regions, 3) implementation of policy at Region level, 4) barriers and successes of policy implementation, 5) effectively applying policy at Region level, 6) incorporation of policy in planning and implementation, 7) specific guidelines during project scoping, 8) outside of scope, and 9) feedback for other regions. A total of 58 participants were asked to complete the survey. Those who participated in the survey were project managers, district engineers, resident engineers, preconstruction engineers, roadway design leads, and traffic operations engineers of all four regions in the state.

3.2.1 Familiarity with UDOT Active Transportation Policy

The first question that was provided for the UDOT internal survey on the *Inclusion of Active Transportation* policy was to determine UDOT's employee familiarity with the policy. The question stated: Are you familiar with UDOT's Active Transportation Policy? The question sought a yes or no response in order to define how many employees were aware of the policy. The results are presented in Table 3-1.

Table 3-1: UDOT Internal Survey Familiarity Question One Results

Answer	Respondents	Percentage (%)
Yes	35	76
No	11	24
Total	46	100

The majority (76 percent) of the employees of UDOT that were asked to participate in this survey are familiar with UDOT's *Inclusion of Active Transportation* policy. The remaining 24 percent are not familiar with the policy which may result in difficulties in implementing the policy for future projects.

3.2.2 Policy Requirement of Regions

The second question in the internal survey was designed to evaluate UDOT employee's knowledge of the requirements of the policy. The question stated: What does that policy require of the Regions? Of the 46 participants of the internal survey, 17 individuals provided feedback on this question. The general theme of the responses was that active transportation must be considered for every project that is conducted in the Region. A few of the more common responses included:

1. To actively look at active transportation on all projects that are developed in the Region.
2. To consider active transportation in every project. If we are not doing anything to improve it, we need to be able to justify why.
3. That we consider active transportation elements when planning our roadway projects.
4. That we consider active transportation (bicycle, pedestrian, etc.) in all projects.

3.2.3 Implementation of Policy at Region Level

The third question that was asked in the internal survey was to determine if the employees have worked to implement the policy at the Region level. The question stated: How have you worked to implement this policy at the Region level? Of the 46 participants in the survey, 17 responded. Of the 17 respondents, 29 percent of the responses mentioned the use of a Project Definition Document (PDD) as they considered active transportation needs in each project. Other responses suggest using existing bicycle maps and plans to determine the appropriate measures in implementing bicycle infrastructure. A few of the more common responses included:

1. To some extent. All projects require a PDD and Active Transportation is a section that has to be addressed in this document.
2. In our PDD we identify needs and concerns related to active transportation, and we determine what can be done with the project to address these needs.
3. Identified in the PDD approval process.

3.2.4 Barriers and Successes of Policy Implementation

The fourth question in the internal survey was to determine what barriers and successes UDOT employees have had in implementing the policy. The question stated: What barriers and/or success have you faced in implementing the policy? Again 17 of the total 46 responded to this question. The most noted challenge that employees reported having been faced with in implementing the policy is funding. Of those who responded 65 percent made mention that funding is a major challenge that makes implementing active transportation difficult. Others noted that employees of UDOT can make it difficult in implementing the policy due to their lack of interest in active transportation. A few of the responses included:

1. The biggest concern I have is the lack of funding set aside for active transportation. Often we do not have money available to make these improvements. Also, it is a bit unclear on how far we are expected to go with active transportation improvements. How much bike traffic is needed before we can justify a bike lane? It is a very subjective process, determining the bike/pedestrian needs with each project. This makes it hard to reach a consensus in project meetings.
2. Money and the type of funding are typical barriers.
3. Funding, competing interests, some that don’t want to compromise.

3.2.5 Effectively Applying Policy at Region Level

The fifth question in the internal survey was designed to address application of the policy at the Region level. The question stated: How could the policy be more effectively employed at the Region level? Only 16 of the 46 participants responded to this question. This question produced the most diverse answers from all of the questions provided. Some responses noted that a continued emphasis at each level in each Region needs to be made. In addition, education on the active transportation policy and what is expected of the Regions was noted. Some of the specific responses included:

1. I think that there needs to be a frank conversation with ALL of UDOT's employees stating our direction. I think only some employees are on board.
2. Continued emphasis at all levels.

3.2.6 Incorporation of Policy in Planning and Implementation

The sixth question that was addressed in the internal survey was how to incorporate the policy in planning and implementation. The question stated: How could the Region most effectively incorporate active transportation into their planning and implementing processes? Of the initial 46 participants, 15 provided feedback on this question. Many of the participants suggested that the policy be looked at as early as possible in the project. Most of the responders stated that the policy should be reviewed at the concept level and scoping process of each project. A few of the specific comments included:

1. This needs to be considered in the scoping process prior to funding the project.
2. At the concept level.
3. Make sure it is being looked at as early as possible.

3.2.7 Specific Guidelines During Project Scoping

The seventh question in the internal survey asked participants if specific guidelines would be helpful during project scoping. The question stated: Would it be helpful to have specific guidelines to refer to during project scoping? Of the 46 participants, 17 provided feedback on this question. The survey revealed that 94 percent of the respondents suggested that specific guidelines would be helpful in the project scoping. Many suggested that guidelines would be helpful but the guidelines should not be so strict that they would limit implementation. A few of the comments included:

1. Yes…but not too specific. I don't think an extensive checklist of items is necessary, but it may be nice to have a general idea of things that can be done with certain types of projects on different classifications of roads.
2. Yes, specific guidelines are good as long as they do not become strict policies. Balance is the elusive goal when dealing with limited funding.
3. Yes, we need more specific guidelines, but not so rigid that we are not allowed to make judgement calls.

3.2.8 Outside of Scope

The eighth question in the internal survey was to explore if employees of UDOT are doing anything outside the scope of the policy to accommodate bicycles. The question stated: Are you doing anything outside of the scope of the Active Transportation Policy to accommodate bicycles in your planning/implementing? The survey revealed that 56 percent of the 16 individuals that responded to this question said they do not do anything outside the scope of the policy to accommodate bicycles. In past TAC meetings it was noted that this question may have been poorly worded and thus the results should be used with caution.

3.2.9 Feedback for Other Regions

The ninth and final question of the internal survey was if the employees have any other feedback they would like to provide. The question stated: Do you have any feedback for other Regions that may help them better apply the Active Transportation Policy? Most of the participants responded that they do not have any additional feedback to provide.

3.3 Household Survey

The following results were from a subset of the results of the household survey conducted by WFRC in the state of Utah from March to July of 2012. The survey was conducted to a random selection of individuals in the following counties: Cache, Davis, Salt Lake, Utah, Washington, and Weber to get feedback on all aspects of transportation. A total of 5,096 people were surveyed. Participants were given the option to provide more than one answer for the questions given. Figure 3-1 and Figure 3-2 shows that 43 percent were between the ages of 25 and 44 and over 56 percent of the people from the survey live in Utah and Salt Lake counties.

One of the questions related to bicycle use in the household survey was to assess how much bicycling each individual did. In general, only 44 percent of those surveyed rode with any frequency, with 2,254 people stating that they ride at some frequency. Of those 2,254, 69 percent were within the age of 25-54, accounting for 58 percent of the total range. This shows that this age group is more likely to ride a bicycle than any others. The highest group was in the age range of 25-34, with 31 percent who ride. Figure 3-3 summarizes the general frequency of ridership.

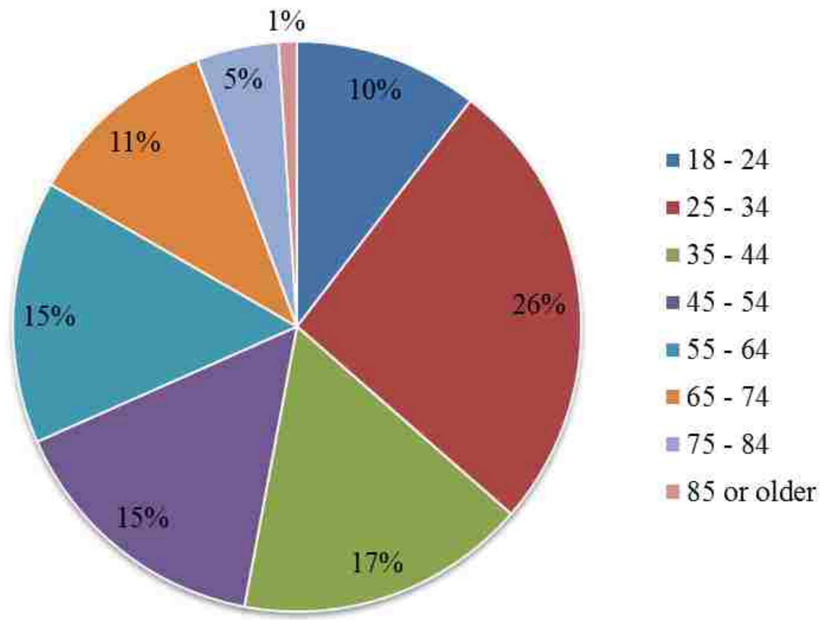

Figure 3-1: Utah household survey participant age.

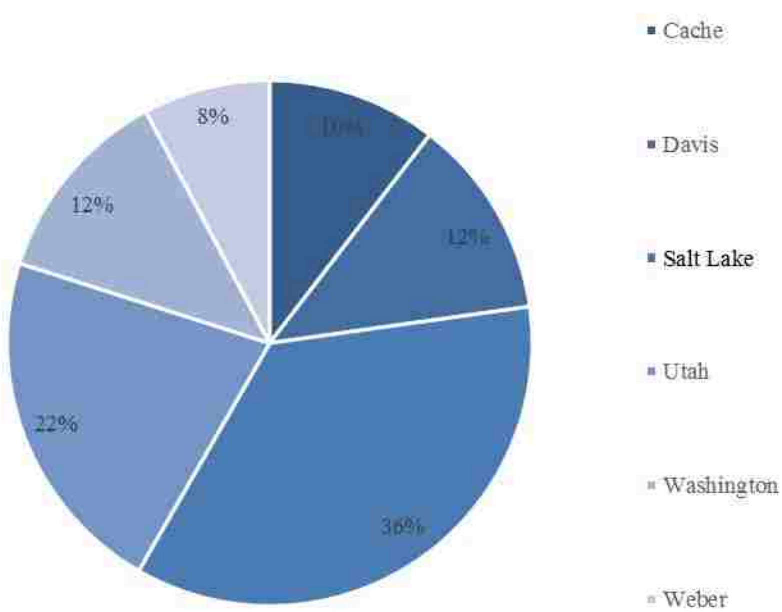

Figure 3-2: Utah household survey participant county code.

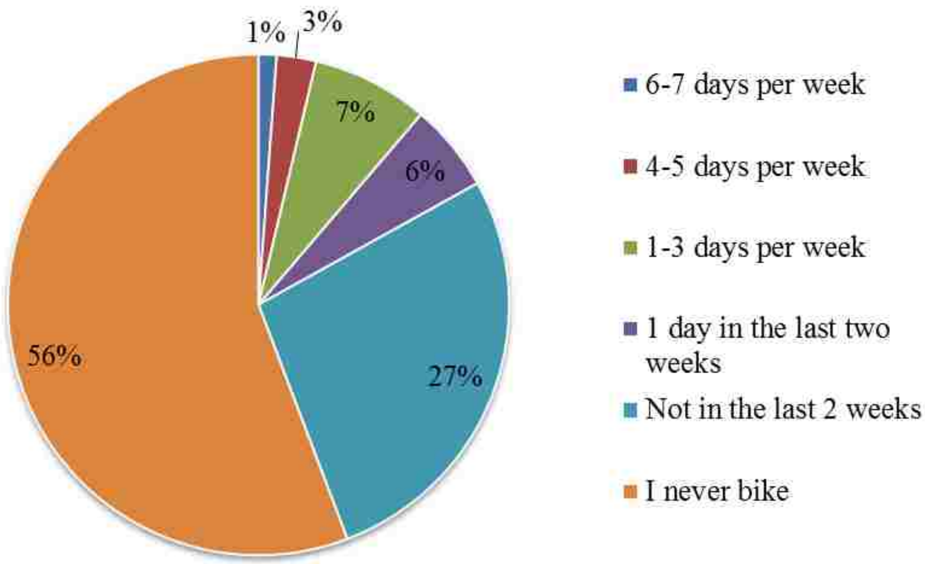

Figure 3-3: General frequency of bicycle ridership.

Figure 3-4 through Figure 3-7 show the breakdown of bicycling habits based on the demographics of age, gender, employment status and location of residence. Figure 3-4 indicates that the age group 35-44 has the highest percentage of people that ride more than once a week. The graph shows the variation in the amount participants ride based on age. This supports the middle age as the strongest riding group. Figure 3-5 shows that slightly more males ride more than once a week than females. Figure 3-6 shows that students were the most likely to ride frequently while those who work full time or were self-employed were likely to go bicycling more than once a week. Figure 3-7 shows that where the participants live seem to have an effect on how much they ride a bicycle. Rural towns have the lowest total percentage of people who never ride, while those who live in cities were most likely to ride 6-7 days.

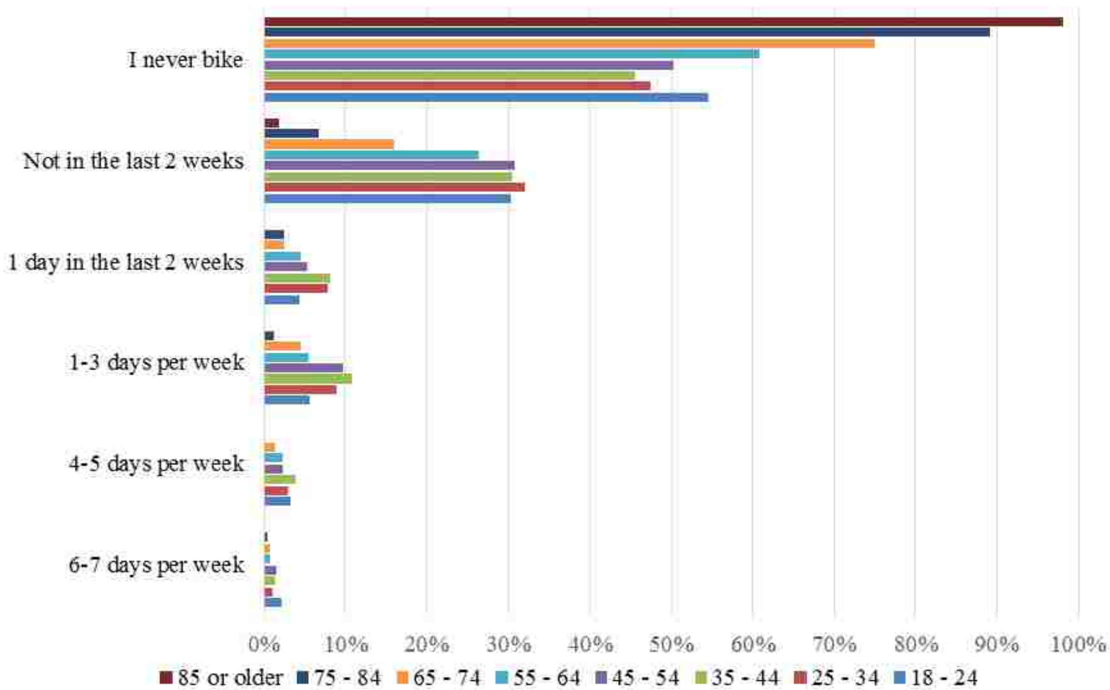

Figure 3-4: Bicycle ridership frequency by age.

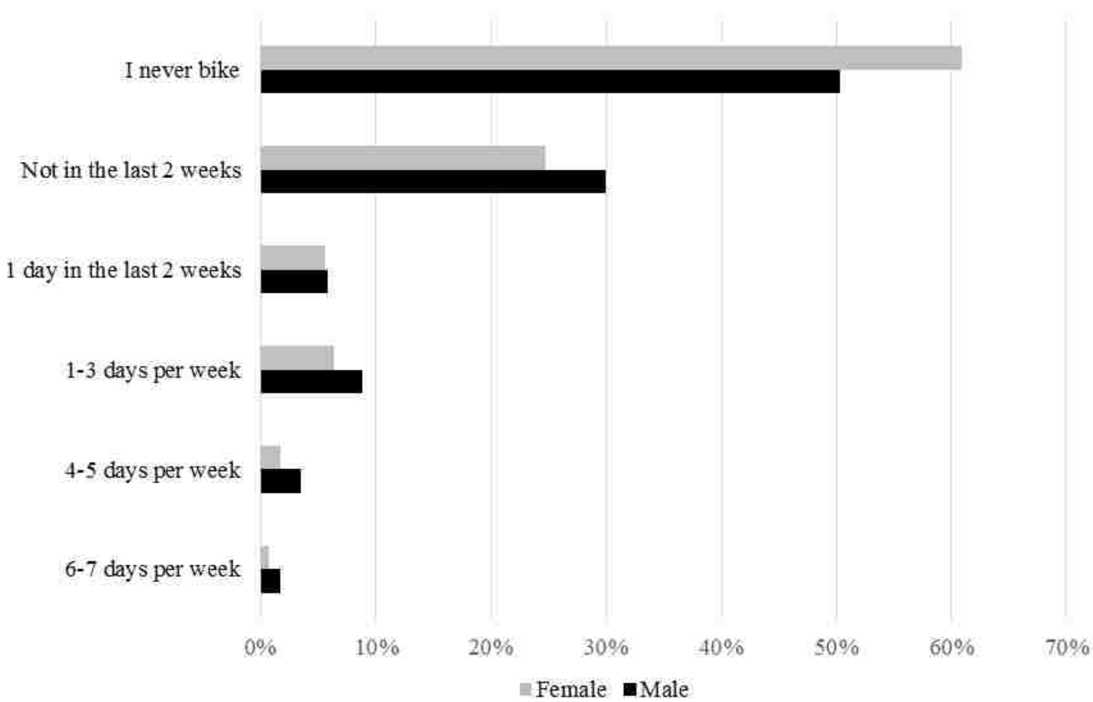

Figure 3-5: Bicycle ridership frequency by gender.

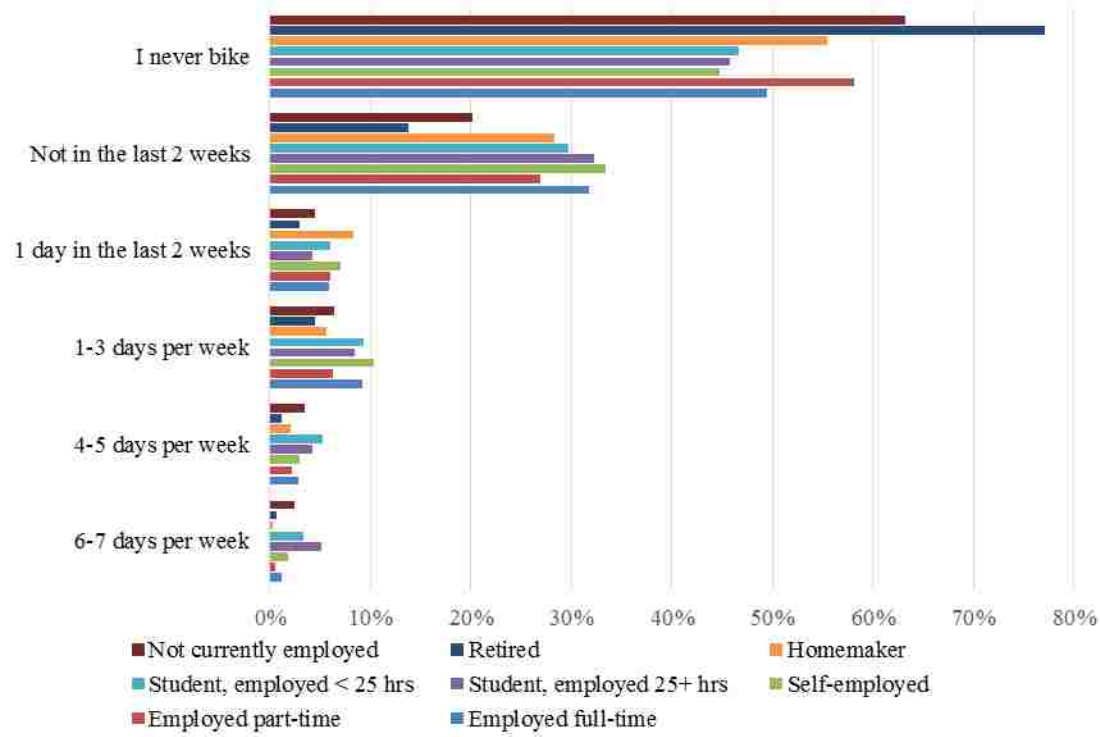

Figure 3-6: Bicycle ridership frequency by employment status.

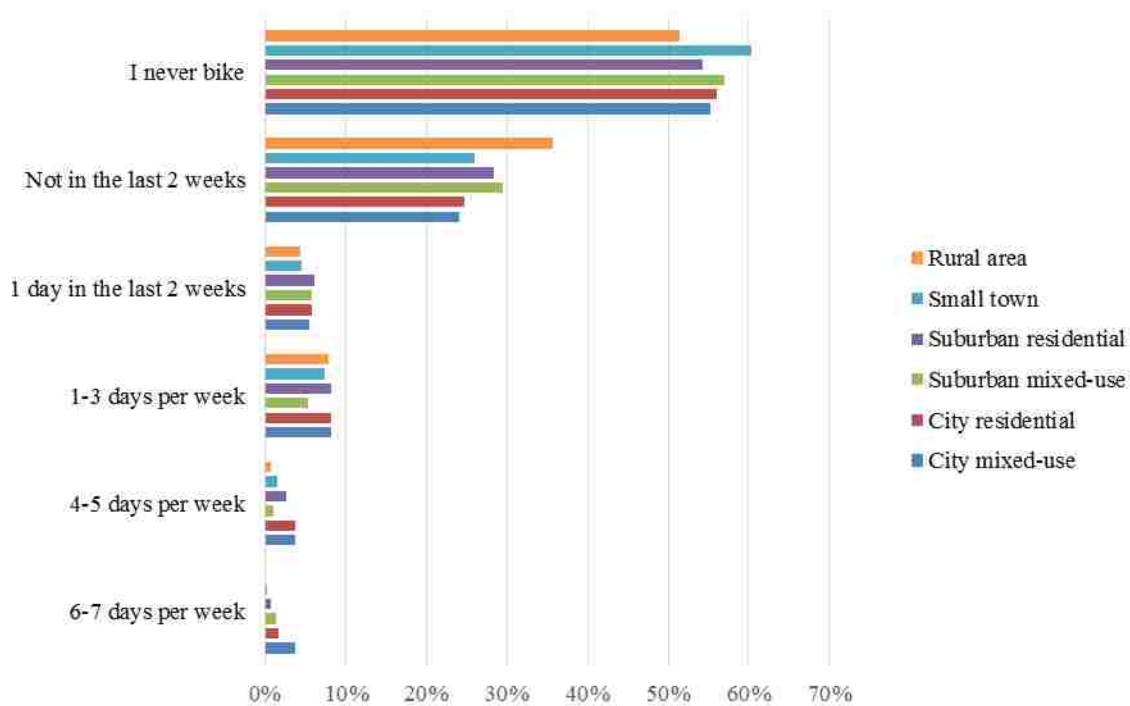

Figure 3-7: Frequency by location of residence.

3.3.1 Reasons for Not Bicycling

Those respondents who stated that they never ride a bicycle were then asked about the reasons why they do not ride. This question allowed for each person to select multiple reasons for why they did not ride. The options presented include:

- Poor/unpredictable weather
- Too busy
- Need/want to use vehicle for other reasons
- Feel unsafe riding in traffic
- Too few off-street bicycle paths or trails
- Too few on-street marked bicycle lanes
- Takes too long to ride to the places I go
- No showers/facilities to change after bicycling
- Do not like/enjoy bicycling
- Health
- Do not own a bicycle
- Other reason

Figure 3-8 shows the overall percentage of people who did not ride for each reason. The graph shows that the number one reason for not bicycling was that they did not own a bicycle to ride. Other reasons that ranked high were lack of enjoyment, feeling unsafe with traffic, and being too busy.

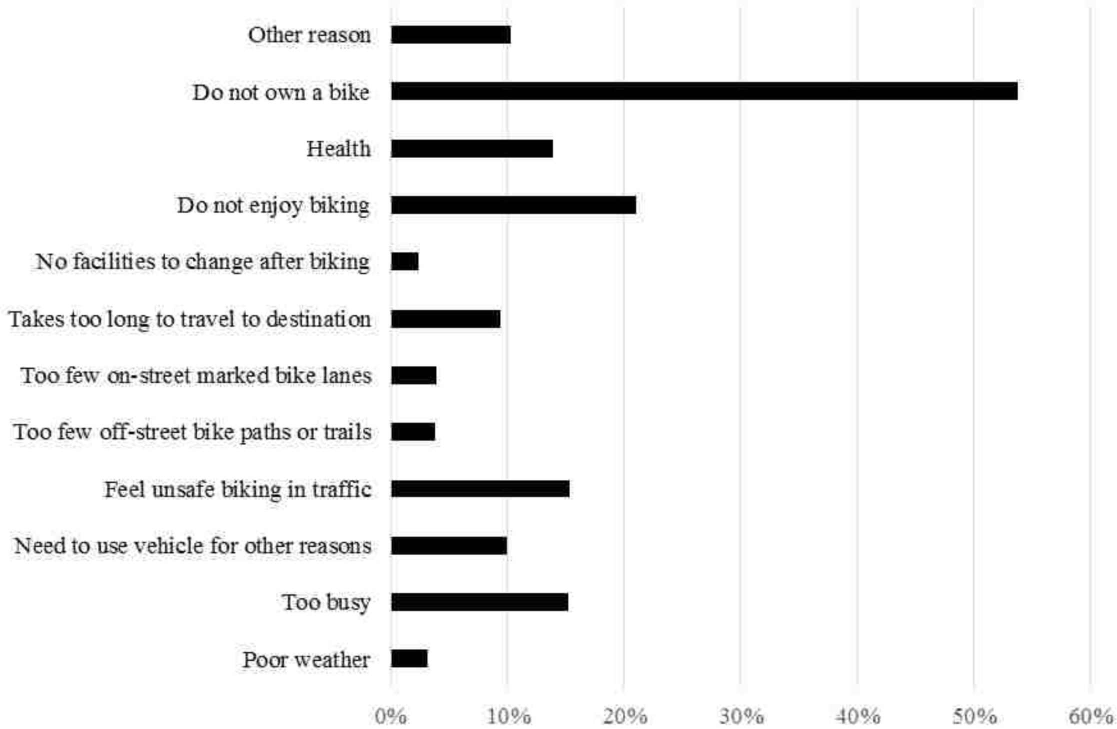

Figure 3-8: Reasons for not bicycling.

Figure 3-9 through Figure 3-12 show the reasons grouped by demographics. Figure 3-9 shows the results by age. Figure 3-10 shows the results by gender. Figure 3-11 shows the results by employment status. Figure 3-12 shows the results by location of residence.

Based on the results of Figure 3-8 through Figure 3-12, trends for the reasons why people don't ride can be seen. Health becomes a bigger issue as someone gets older whereas time becomes less of an issue. Men feel time is a big reason while safety is a bigger concern to women. Time is more of an issue to people who were employed and live in rural areas, while weather and a lack of facilities were lower factors. It should be noted that these were people who stated that they never ride and may not be aware of what facilities may or may not be available. Bicycle ownership again appears to be the main reason.

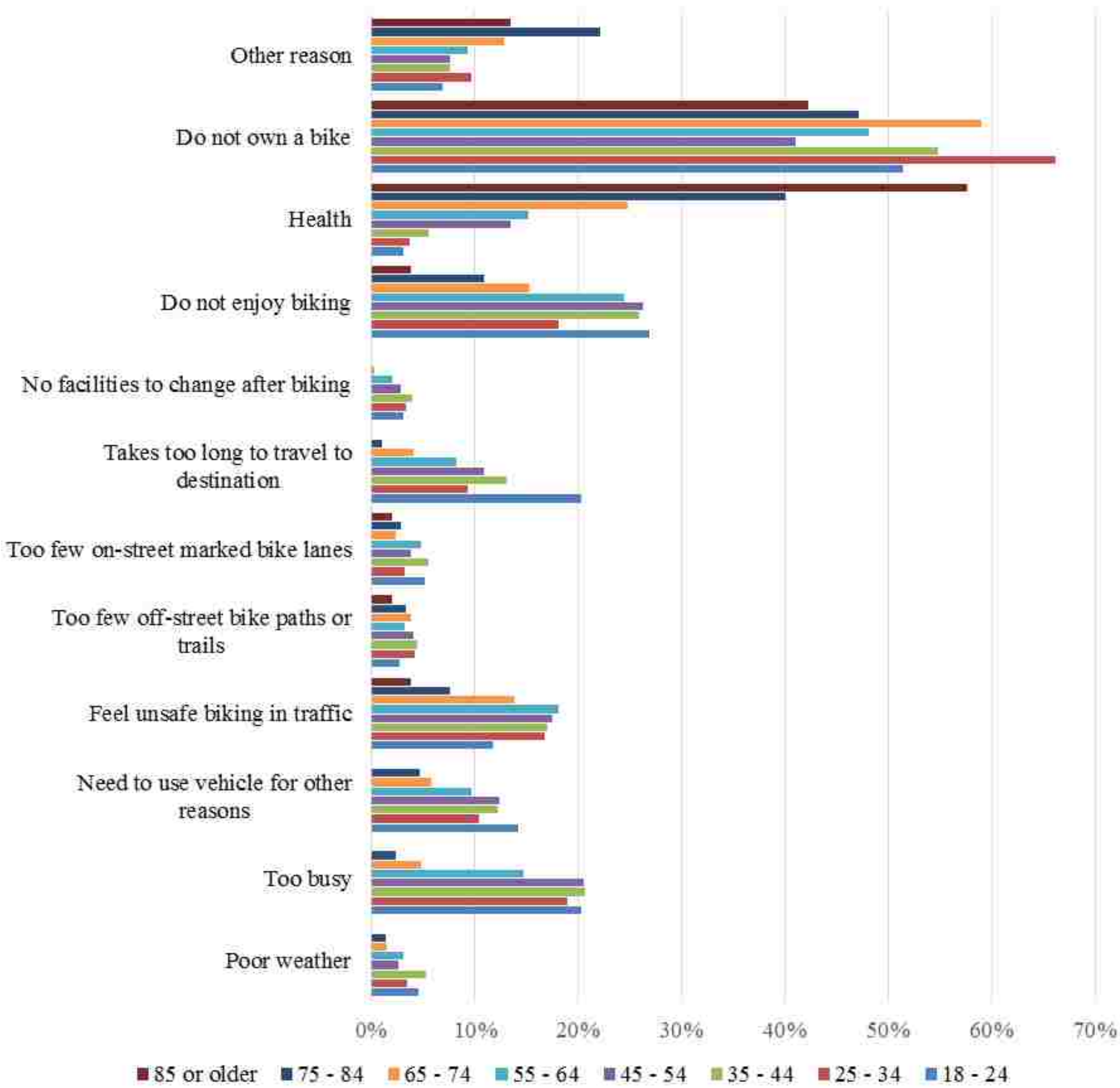

Figure 3-9: Reasons for not bicycling by age.

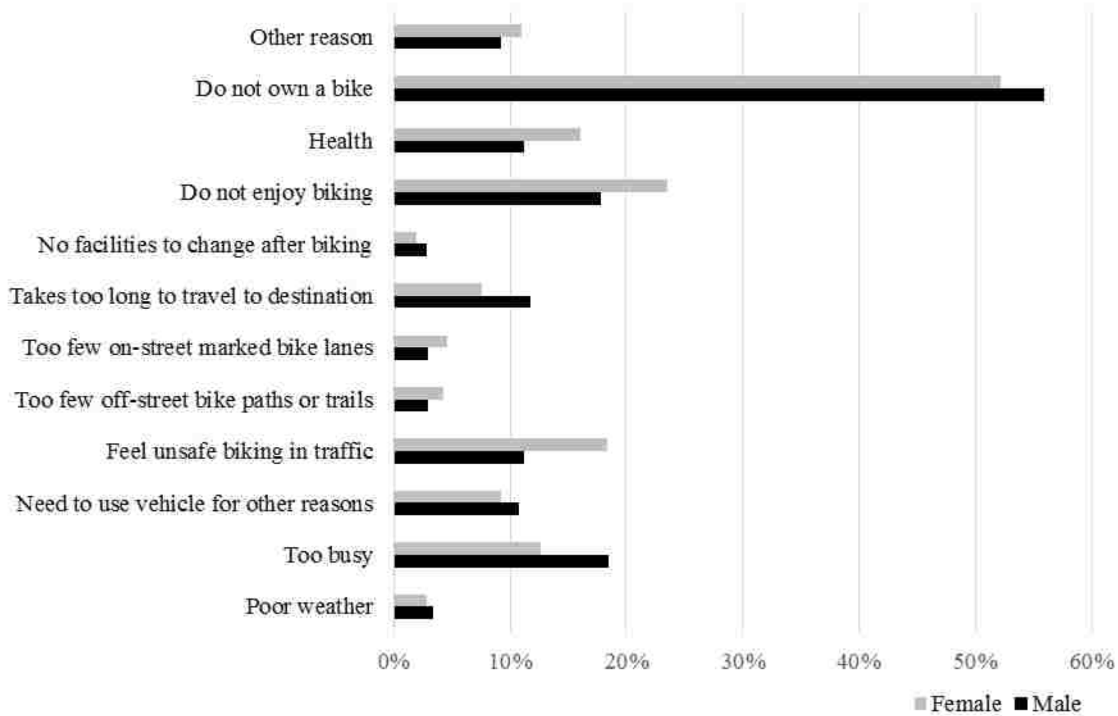

Figure 3-10: Reasons for not bicycling by gender.

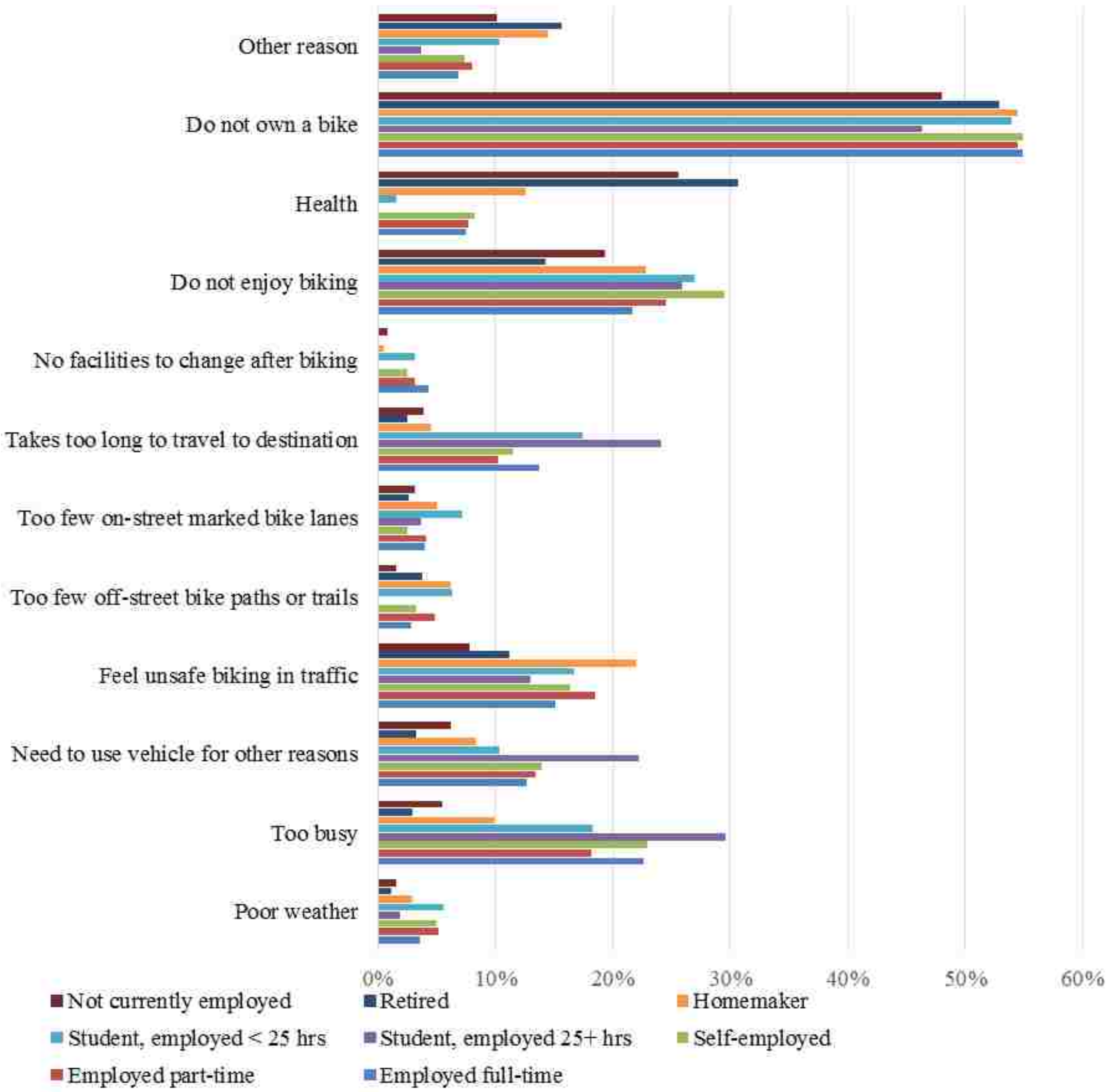

Figure 3-11: Reasons for not bicycling by employment status.

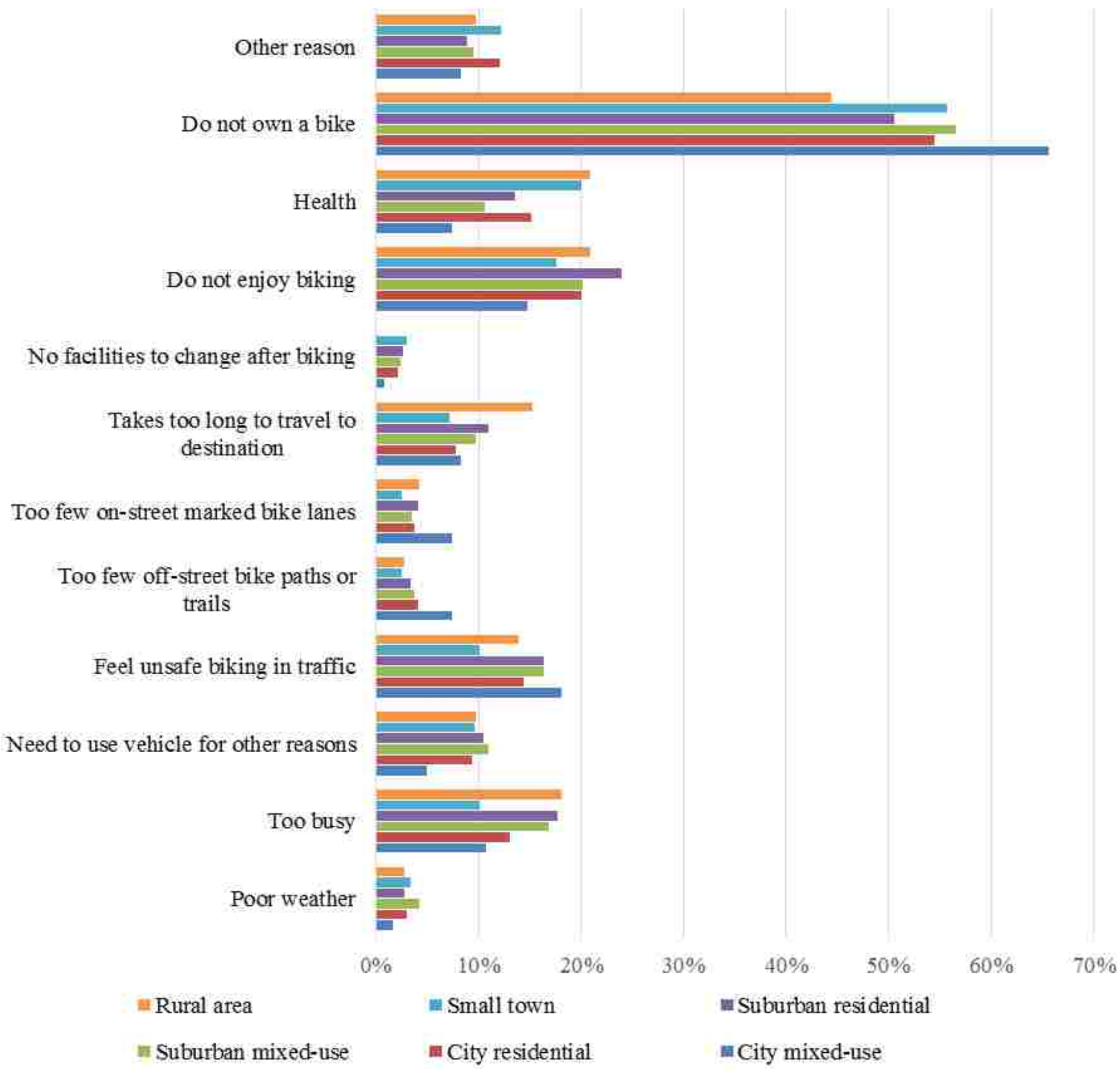

Figure 3-12: Reasons for not bicycling by locations of residence.

3.3.2 Purpose for Bicycling

Those respondents who stated that they rode a bicycle at some frequency were then asked two questions. The first asked for the purposes for using a bicycle and the second inquired as to the reasons for riding a bicycle. The options that could have been selected for the purpose of riding a bicycle were:

- Exercise
- To socialize with others (bicycle club, training group, coworkers, etc.)
- To ride with (accompany) children
- To go to/from work
- To go/from school
- To go to/from other travel mode
- To go shopping (grocery, mall, etc.)
- Personal business
- Visit friends/family
- Recreation Event
- Other reason

In addition to the purpose of riding a bicycle, participants provided reasons why they use a bicycle. The reasons were:

- Reduce impact on environment/air quality
- Avoid traffic congestion
- Save money on gas and travel costs
- More convenient than driving
- Faster than driving
- Health/exercise
- To enjoy being outside
- Other reason

Figure 3-13 and Figure 3-14 show the general responses to the questions. Each person was able to select multiple purposes and reasons. The graphs show that the primary purpose for using a bicycle is exercise with the second being to ride with children. The main reasons were for health and to be outdoors.

Additional evaluation was done on the responses to the purpose of riding a bicycle. Figure 3-15 through Figure 3-18 break down the purposes for each of the main demographics selected for this study (age, gender, employment status, and location of residence). Figure 3-15 shows how the purpose of riding a bicycle might change as someone grows older.

Figure 3-15 through Figure 3-18 show that as age increases most of the purposes decrease in importance. A few notable exceptions include exercise, which generally increases as people get older and shopping and visiting which spike at the age group of 75-84. Males and females generally had the same responses to the purposes with females using bicycles slightly more for children and visiting friends. Employment had the most variation with students being the most likely to use them for school and work and homemakers having a very high percentage of using bicycles with children. Location of residence showed a very consistent decreasing trend for most of the purposes as the population density of the location decreased. Cities with mixed land use (City mixed use) had the highest for all purposes except riding with children and exercise. The question asked the respondent to state to what level they agree or disagree with each statement. In general, most people agreed that bicycling was important and that they would like to ride more often than they currently do. The data were evaluated deeper to determine if the responses to agreement varied based on the amount of riding the person does. Figure 3-19 is based on the data from a final question in the survey about walking and bicycling.

Using the amount of riding each person does the participants were grouped into three categories. If they rode for 4 or more days a week they were classified as active; 1 to 6 days to every two weeks was classified as moderate; and "never" was classified as none. Using these groups the percentage of those who agreed and disagreed for each group were calculated. Figure 3-20 provides the results of the analysis.

The data showed that the response distribution changes significantly compared to the general distribution. When looking at frequency distribution it is shown that a majority of active riders do not think that there were enough facilities to meet their needs. Moderate riders equally agree and disagree on the facilities. It is also notable that almost twice the percentage of moderate versus non-riders would like to ride more. Sharing the road is a bigger factor for the moderate riders than the non-riders. Moderate and active riders were also more likely to support funding for more facilities. Figure 3-20 indicates that the more someone rides the more supportive they become, and that they also become more aware of a shortage of facilities.

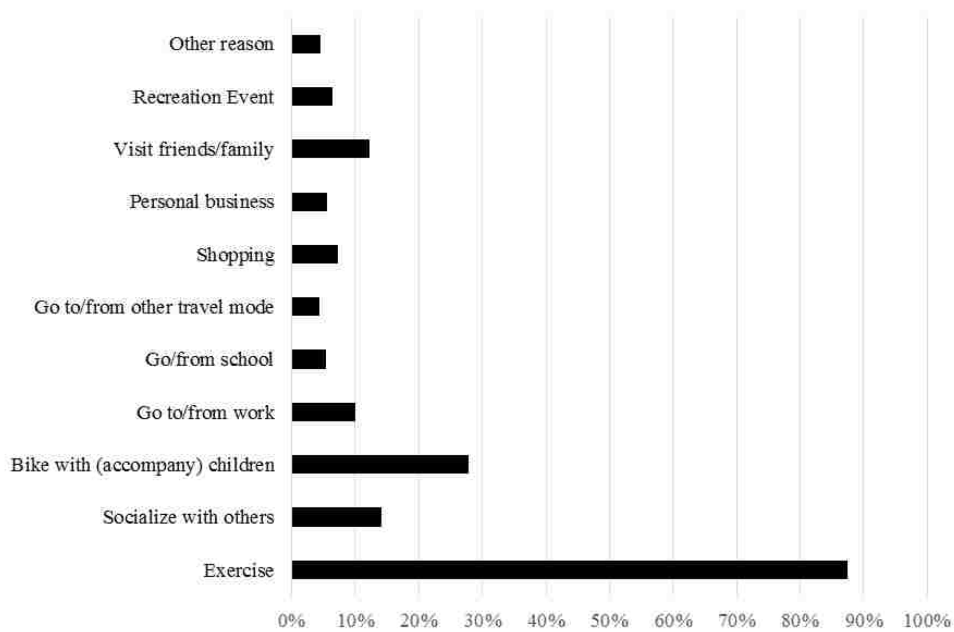

Figure 3-13: General purpose for bicycling.

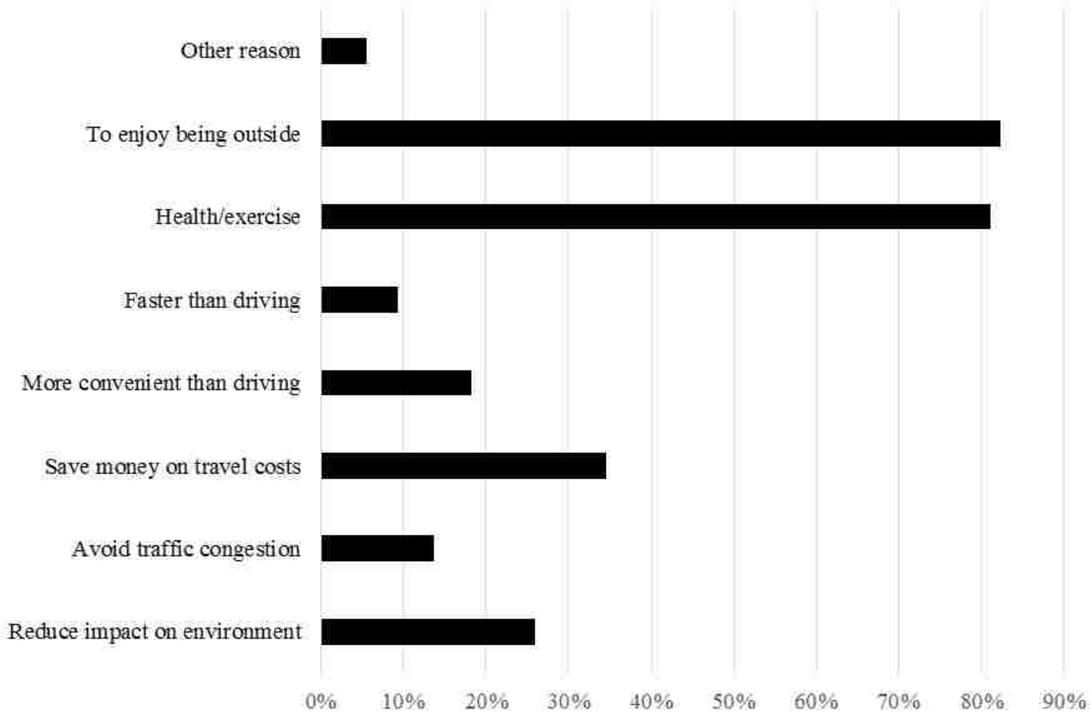

Figure 3-14: General reasons for bicycling.

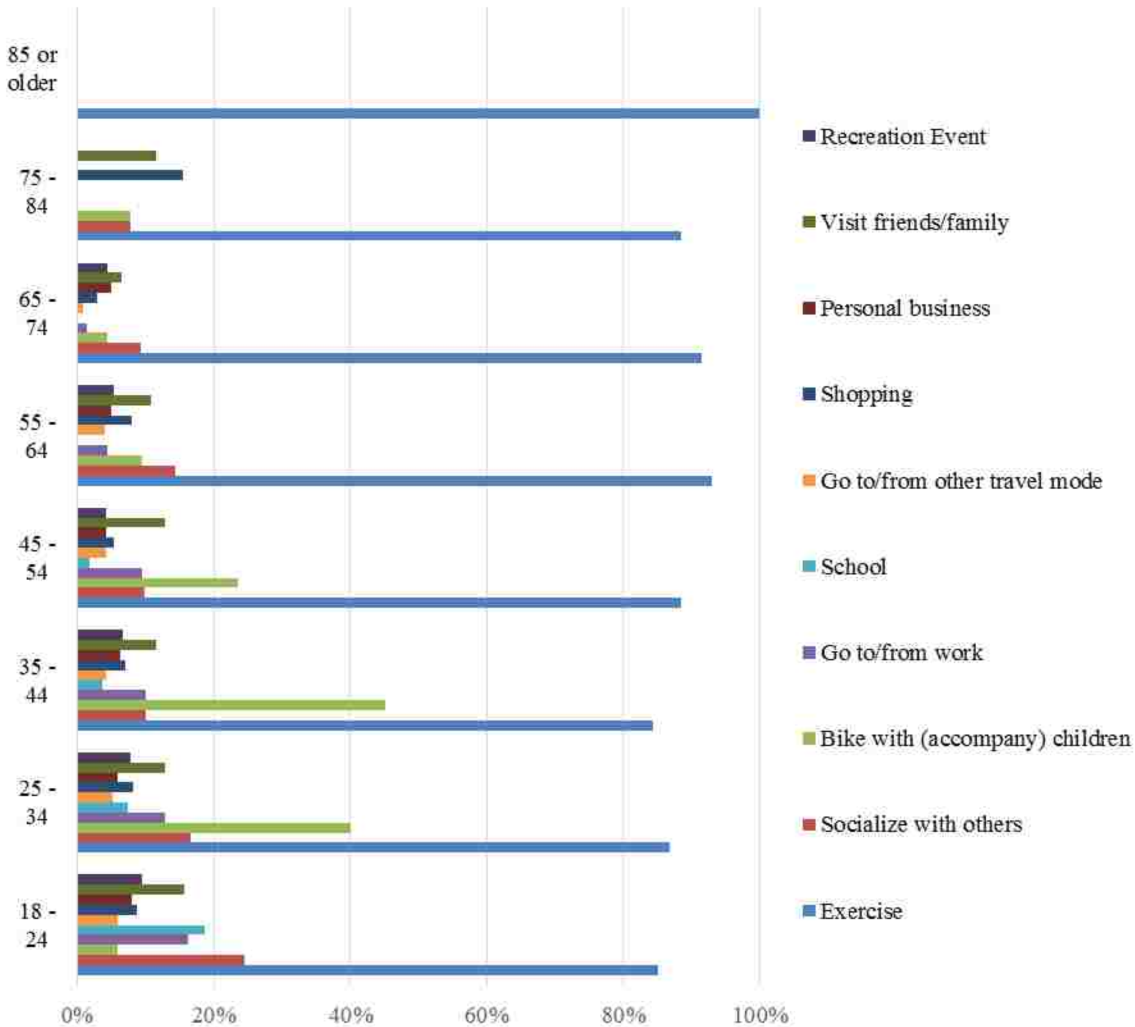

Figure 3-15: Purpose for bicyling by age.

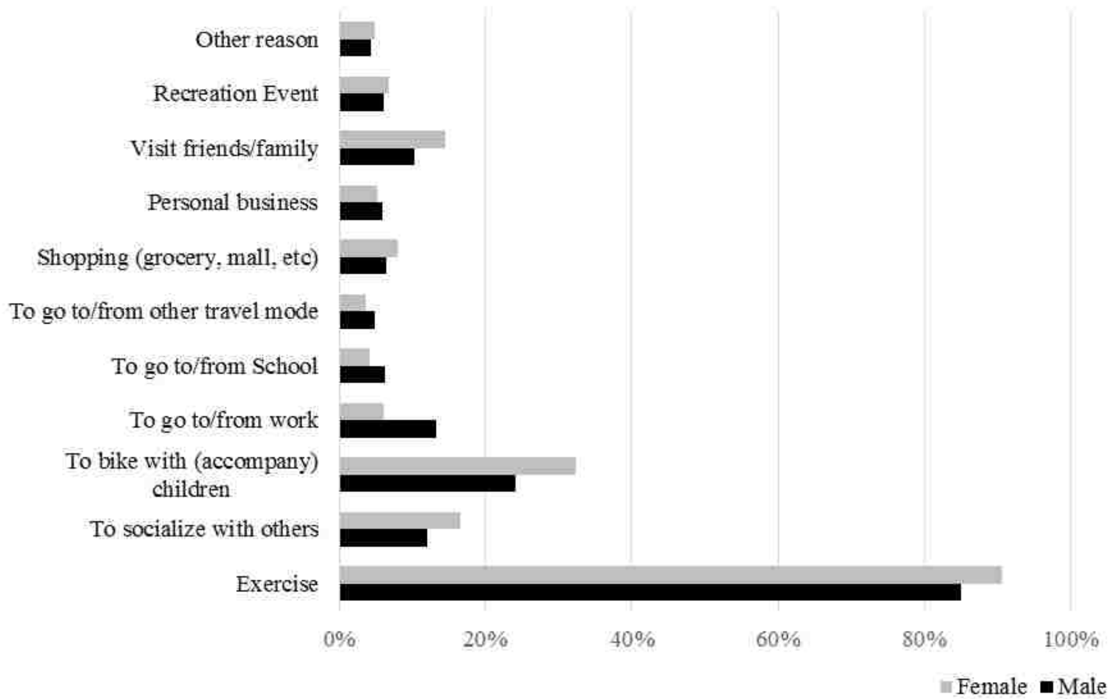

Figure 3-16: Purpose for bicycling by gender.

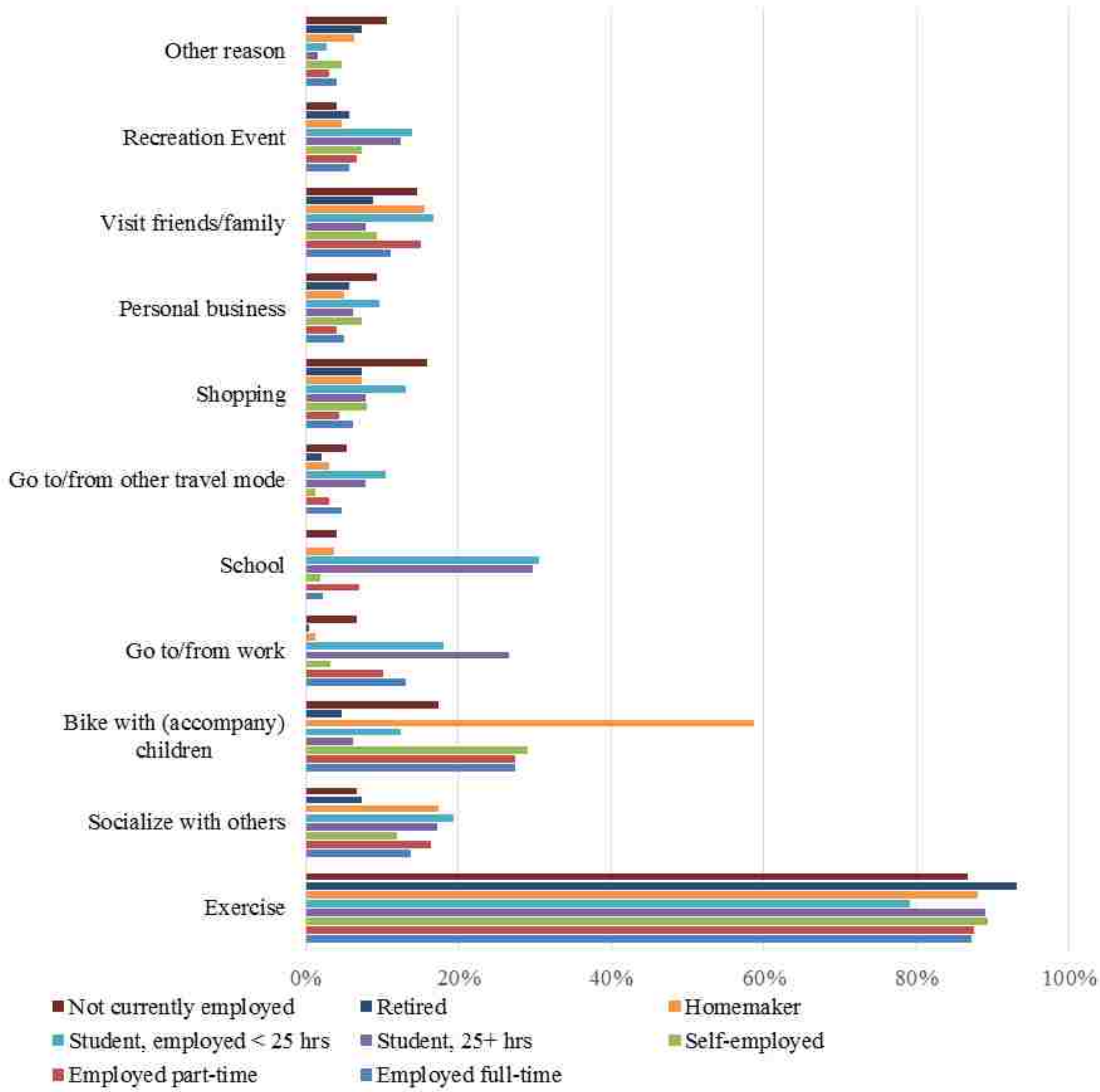

Figure 3-17: Purpose for bicycling by employment status.

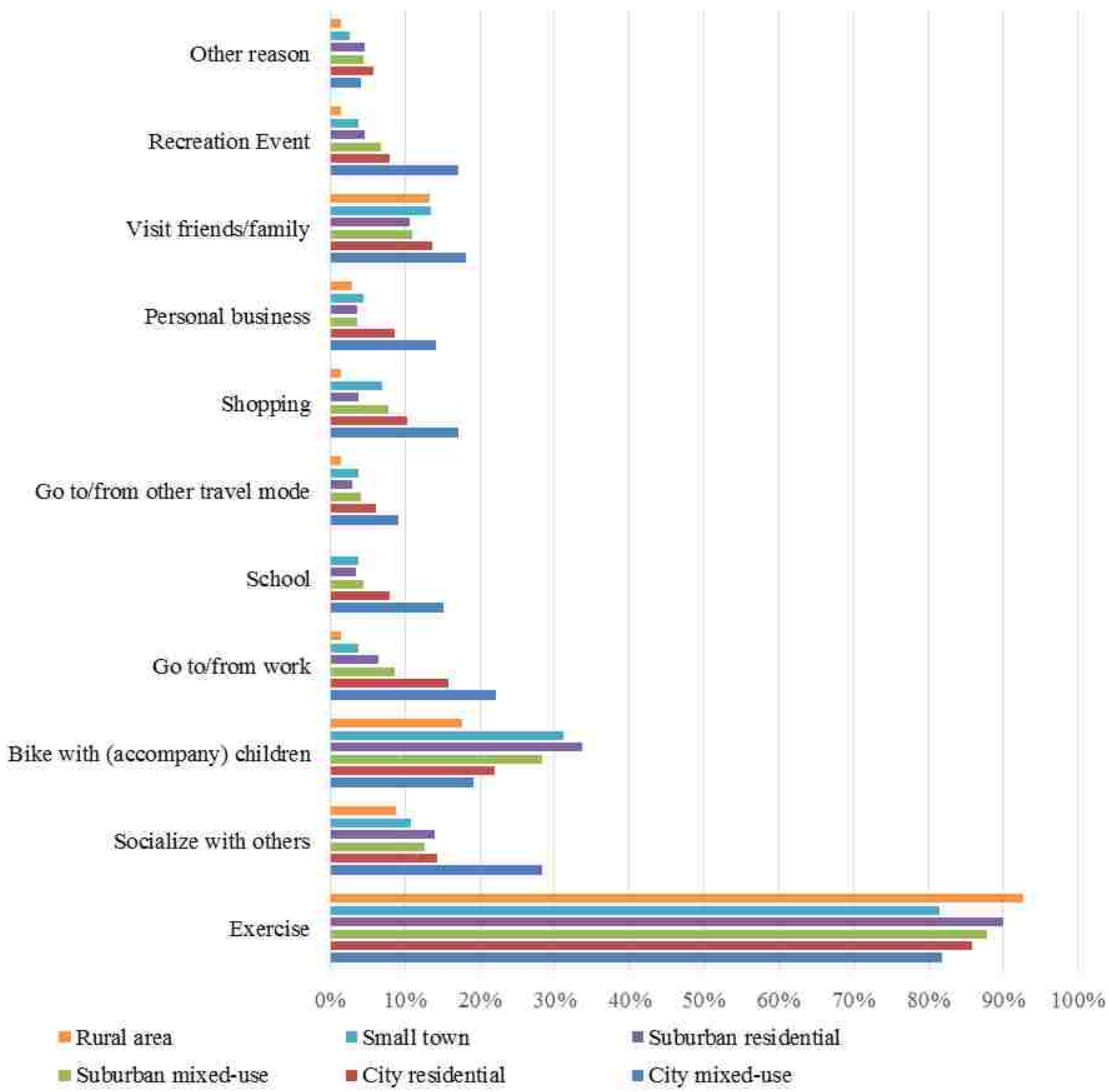

Figure 3-18: Purpose for bicycling by location of residence.

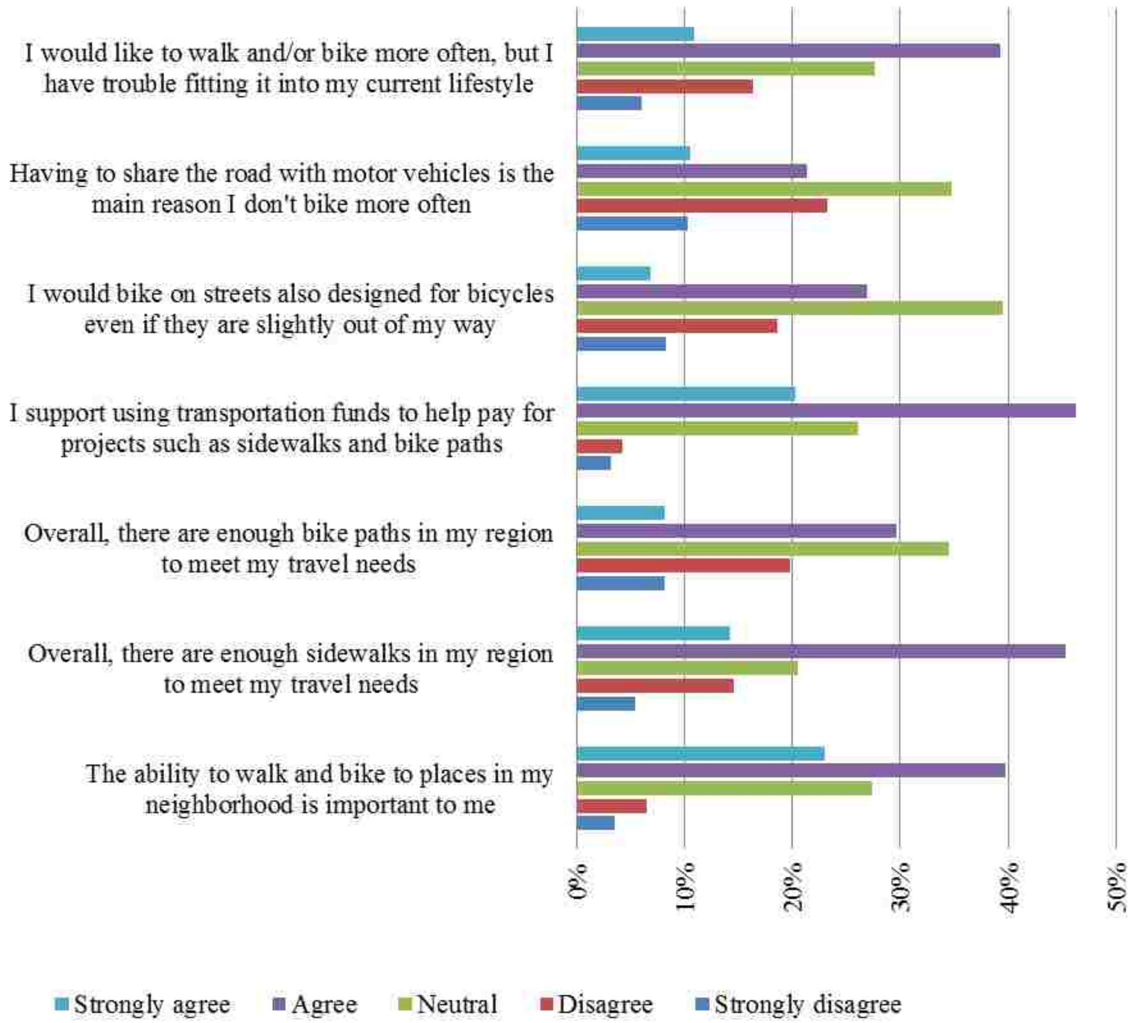

Figure 3-19: How strongly do you agree?

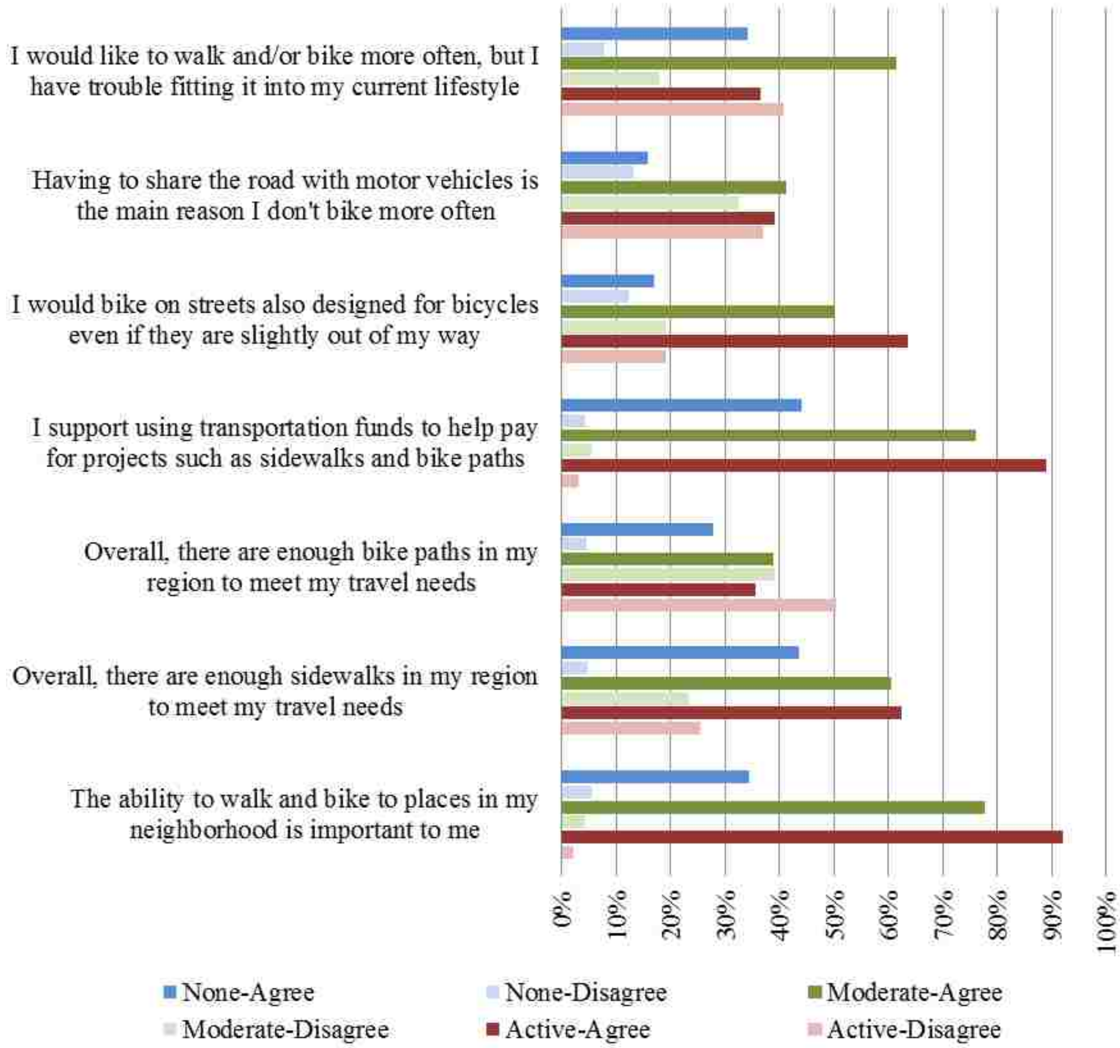

Figure 3-20: Agreement based on frequency.

3.3.3 Limitations to Data

The current survey did not cover differing types of facilities and the willingness of the respondent to use one versus the other. The data did indicate that the respondents wanted more facilities in addition to safe facilities away from traffic. This leads to the need for a more detailed survey on safety and facility types. The data were also limited in what factors would persuade more people to bike. The results indicated that more people want to ride but did not get into the "what would it take" or "how can the state help" questions. A big limitation is the sheer quantity of data. Evaluating and compiling the data would be a complete research project itself. There were many cross analyses that could be done including multi-parameters, cross evaluations such as frequency based on age and location, and many more. A full evaluation of the data including implications and recommendations based on findings would be a very large undertaking.

3.3.4 Final Thoughts on the Data

Although over 50 percent of Utah residents do not ride a bicycle, many were willing to ride more. An age group that should be focused on is the 25-45 age groups. Increasing the number of safe facilities in city settings with a focus on access to bicycle and multi-use developments could provide an incentive for more people to ride.

3.4 Chapter Summary

To better understand the knowledge of UDOT's employees in regards to the active transportation, a survey of 10 questions was distributed to selected individuals. The selected individuals were chosen from all levels of UDOT job categories to provide a good representation of UDOT's role in the active transportation policy. Most of the participants in the survey were familiar with the active transportation policy and had a good understanding of implementation of the policy. Most that responded noted that a limiting factor in implementing the policy was insufficient funding to cover the needs of active transportation.

The household survey contains a lot of information on Utah's trend for bicycling and the reasons why people do and do not ride a bicycle in Utah. There is significantly more data than is currently included in this thesis. The data included in this thesis indicates that the strongest age group for bicycling is between 25 and 44 years of age. Exercise is the main purpose for riding a bicycle to increase the health of the individual and to spend time outdoors. Age does have a significant influence on the amount and purpose of riding a bicycle which typically decreases as people grow older. Gender has some but little influence on bicycling with a few purposes being more likely with females than males, such as riding with children. Students were more likely to ride as a commuter than other employment types. The location of the residence has a varying effect on why someone does not ride but greatly affects the purpose of the ride. People living in dense multi use areas were more likely to use a bicycle for most purposes whereas in rural areas it is primarily for exercise. The greatest obstacle to people bicycling is no access to a bicycle and/or the lack of enjoyment. Time and safety were also key issues. The data indicates that the more one rides the more supportive they were for active transportation.

4 RESEARCH METHODS

4.1 Overview

Data collection was fundamental in this research project in determining the impacts of bicycle corridors on travel demands in the state of Utah. With limited amounts of commuting bicycle data available throughout the state, it was necessary to gather bicycle volume data on corridors with and without bicycle infrastructure. TAC members requested that volume data be collected over a minimum of 48 hours at each site location. In order to accomplish this data collection effort, two primary methods were used to collect bicycle volume data. The first method was to use automatic bicycle counters on roadways that had bicycle infrastructure. The second method was to gather bicycle volume data through manual counts on roads with and without bicycle infrastructure. Each of these two methods are discussed in the following sections.

4.2 Automatic Bicycle Counters

The first method in collecting bicycle volume data was the use of automatic bicycle counters. Equipment for the effort was rented from JAMAR Technologies, Inc. Corridors were identified throughout the state with input from the TAC and specific locations were chosen to place the automatic counters. The equipment and procedures for collecting data are outlined in the following subsections.

4.2.1 Equipment

The first equipment item that was used for this method of data collection is the Trax Cycles Plus unit. The Trax Cycles Plus unit is a product of JAMAR Technologies, Inc. that is used to collect bicycle volume data (JAMAR 2015). The unit uses air pressure changes to determine the difference between the sizes of vehicle that it recorded, thus providing an accurate recording of the type of vehicles that pass by the unit. Two units were used to collect data on both sides of the corridors.

The second equipment item used was the mini tubes that connect into the Trax Cycles Plus unit. The mini tubes used for this method of data collection were 0.187 inches in diameter and 40 ft. in length. Two tubes were attached to each Trax Cycles Plus units. A total of four mini tubes were used.

Additional equipment used for this method of data collection was two chains, four locks, end plugs, and 120 ft. of mastic tape. Figure 4-1 provides an image of the equipment used for the automatic method of data collection.

Figure 4-1: Equipment used for automatic counting method (photo taken by Chris Haskell, 2015).

4.2.2 Procedures

The equipment outlined in the previous section was used to collect bicycle volume data according to the approved procedures outlined by JAMAR Technologies, Inc. After specific sites were approved by the TAC members, automatic counters were placed to collect bicycle volumes, the directions of cyclists, and the time of day for each cyclist. The time range that data were to be collected was from 7:00 AM on the first day to 6:30 PM on the second day. This allowed for two days' worth of bicycle volume data during peak hours of traffic. Days of the week that counting occurred was Monday, Tuesday, Wednesday, and Thursday. A few of the sites were also recorded on the weekend at the request of the TAC members. The days classified as weekends were Friday and Saturday. Automatic counters were placed the evening prior to the first day of counting.

The first step in placing the automatic counters was to lay down the first mini tube. A 40 ft. mini tube was placed across the entire width of the bike infrastructure on one side of the road. The end of the mini tube was plugged using a manufactured end plug provided by JAMAR Technologies, Inc. and placed to overhang the bicycle infrastructure by one inch. Overhang of the mini tube allowed for maximum accuracy of cyclists using the infrastructure under investigation. Mastic tape was used to secure the mini tube to the pavement and was spaced 2 ft. apart along the mini tube to minimize movement of the mini tube. Figure 4-2 provides an image of placing the first mini tube.

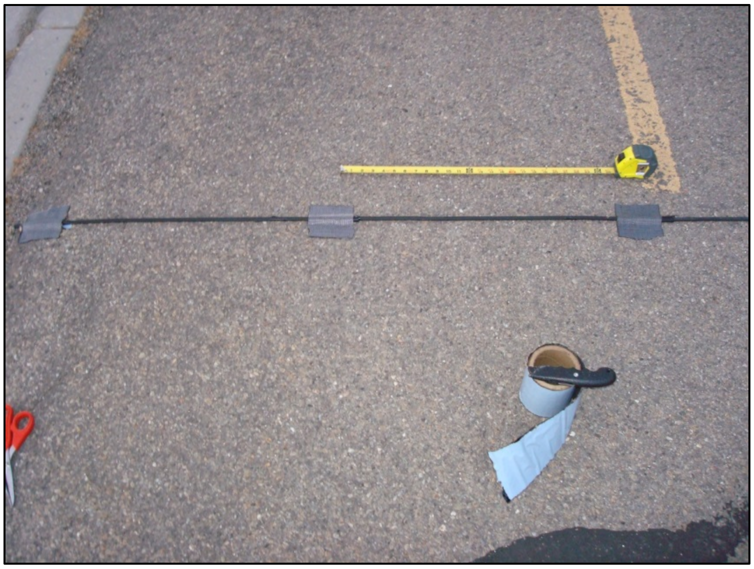

Figure 4-2: Placement of the first mini tube (photo taken by Chris Haskell, 2015).

After the first mini tube is placed the second mini tube is placed in the same fashion. The second mini tube was placed parallel to the first mini tube at a distance of 2 ft. as specified by JAMAR Technologies, Inc. so as to collect accurate bicycle volume data. Figure 4-3 provides an image of the placement of the second mini tube.

Figure 4-3: Seperation of first and second mini tube (photo taken by Chris Haskell, 2015).

After placement of mini tubes on pavement the remaining mini tube is coiled around a light pole or telephone pole. The mini tubes are placed in a tight coil to provided proper operation of the unit. Figure 4-4 provides an image of the remaining mini tube coiled around a telephone pole.

Figure 4-4: Placement of remaining mini tubes (photo taken by Chris Haskell, 2015).

The mini tubes are then connected into the Trax Cycles Plus unit. The first tube is classified as Tube A and is inserted into the A slot in the unit. The second tube is classified as Tube B and is inserted into the B slot in the unit. Setting L6 was used in order to collect bicycle traffic going in both directions on one side of the road. The unit was started and then chained to a light pole or telephone pole for security reasons. The same procedures were used for the second Trax Cycles Plus unit placed on the opposite side of the road. Figure 4-5, Figure 4-6 and Figure 4-7 provides images of the units and the mini tubes placed on the pavement of bicycle paths and roadways.

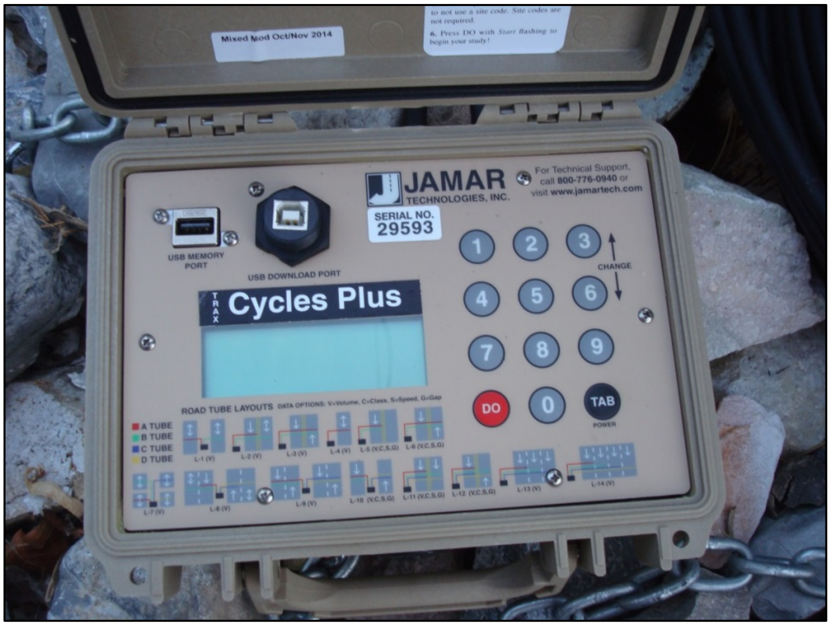

Figure 4-5: View of the Trax Cycles Plus unit (photo taken by Chris Haskell, 2015).

Figure 4-6: Placement of Trax Cycles Plus unit (photo taken by Chris Haskell, 2015).

Figure 4-7: Placement of mini tubes (photo taken by Chris Haskell, 2015).

4.3 Manual Bicycle Counting

The second method for collecting bicycle volume data at each of the sites was manual data collection. Upon arrival of the site of interest bicycle volume data was collected three times a day for two days. Bicycle counts were collected during the three peak traffic periods of the day. To provide an accurate recording of the cyclists, peak traffic periods consisted of two hours. The time ranges that data were collected included 7:00 AM to 9:00 AM, 11:00 AM to 1:00 PM, and 4:30 PM to 6:30 PM. The days of the week that data were collected were Monday, Tuesday, Wednesday, and Thursday. No weekend counting occurred using the manual bicycle counting method.

During each of the peak periods, research members collected bicycle data in 15 minute intervals. During each interval, research members recorded the number, gender, purpose (commute or recreation), direction, sidewalk use, and approximate age of the bicyclists. The field sheet used for manual bicycle counting can be found in Appendix B. The first category that was recorded by the research members was the number of cyclists during each interval. Cyclists were recorded at the time that they passed the specific address of the street that was under investigation. The second category was the gender of the cyclists. The gender of the cyclists was recorded and was classified as either male or female for each interval. The third category recorded was the purpose of the cyclists. The purpose of the cyclists was categorized as either commuter or recreational. The general definition of commuter cyclists is a cyclist who is riding a bicycle to travel to work, school, or other daily activities. The description of commuter cyclists would be an individual who has one or more of the following characteristics: wearing business related clothing which may be defined as suit pants, khakis, skirt, dress, blouse, button down shirt, tie, etc.; wearing casual clothes used for school or other daily activities; and use of backpack, side bag, and/or bike saddle bag. It is also noted that if a cyclist is wearing spandex but has one of the items listed in number three of the above list the cyclists is labeled as a commuter. Figure 4-8, Figure 4-9, and Figure 4-10 provide images of commuting cyclists.

Figure 4-8: Commuting cyclists wearing business attire (Google 2015).

Figure 4-9: Commuting cyclist wearing casual attire with groceries (Google 2015).

Figure 4-10: Commuting cyclist wearing spandex but wearing backpack (Google 2015).

The general definition of recreational cyclists is a cyclist who is riding a bicycle for exercise. The description of recreational cyclists would be an individual who is wearing either spandex or exercise related clothing with no appearance of a backpack, side bag, and/or bike saddle bag. Figure 4-11 and Figure 4-12 provide images of recreational cyclists.

Figure 4-11: Recreational cyclists (Google 2015).

Figure 4-12: Recreational cyclists wearing spandex (Google 2015).

The research members included the direction the cyclists were heading such as north/south and east/west. In addition, whether the cyclists used the sidewalk, road, or bicycle infrastructure was noted. The last category defined the approximate age of the cyclists. The three age subcategories were defined as youth, adult, and senior. Youth was defined as those who appeared to be under 18 years of age. Adult cyclists were classified as those assumed to be 18 to 64 years of age. Seniors were classified as those who appeared 65 and older in age. The judgement of the researcher collecting the manual bicycle data was used in estimating the age of the cyclists.

4.4 Chapter Summary

Two methods of data collection were used for this research project. The first method was using automatic counters to collect bicycle data over a 48 hour time frame. The second method was to collect bicycle volumes manually for two days during the three peaks hours. The first method was used for collecting bicycle volumes and the second method was used according to the needs and limitations of the site.

5 DATA COLLECTION

5.1 Overview

The research methods outlined in Chapter 4 were used in collecting the bicycle data for this project. Each site under investigation was observed using one of the two research methods, automatic and manual data collection. Bicycle data were collected in five counties throughout the state of Utah: Davis, Salt Lake, Utah, Washington, and Weber County. The locations of these counties are outlined in Figure 5-1. The following section summarizes the data collected for each of the five counties.

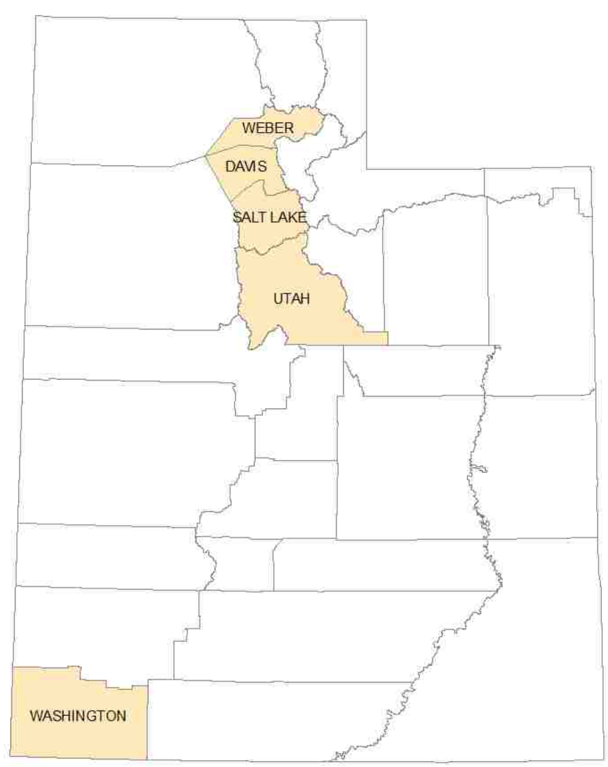

Figure 5-1: Location of Davis, Salt Lake, Utah, Washington, and Weber Counties.

5.2 Davis County

Two sites were observed in Davis County for the research project as summarized in Table 5-1 and illustrated in Figure 5-2. The details for each of the sites are provided in the following subsections.

Table 5-1: Davis County Sites

Site ID	City	Street	Data Collection Site	Bicycle Infrastructure
D1	Syracuse	1700 South	1518 West	Bike Lane
D2	Syracuse	2700 South	1518 West	None

Figure 5-2: Davis County site locations.

5.2.1 Site D1: 1700 South at 1518 West, Syracuse

The first street observed in Davis County was 1700 South in Syracuse. Observations were made at the site and it was determined that 1518 West was a representative location to collect bicycle data on 1700 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 1700 South as an Other Principal Arterial. The most recent vehicle traffic volumes for 1700 South were collected in 2013 and were reported to be 24,890 vehicles per day (vpd). It was observed that four lanes are present at the site and the posted speed limit is 45 mph. A total of 24 access points were observed along a three block segment between 1100 West and Branbury Drive. The land use at 1700 South 1518 West is residential and commercial. The pavement is made of Portland Cement Concrete (PCC). The road attributes are summarized in Appendix C. Figure 5-3 provides an image of the site.

Figure 5-3: View of 1700 South at 1518 West, Syracuse (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on 1700 South is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. The bike lane is adjacent to the travel lane and is separated from the sidewalk by a shoulder. Figure 5-4 provides an image of the bike lane in the westbound direction.

Figure 5-4: Westbound view of the bike lane on 1700 South, Syracuse (photo taken by Chris Haskell, 2015).

Bicycle data were collected on 1700 South at 1518 West on July 1 and July 2, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being cloudy. No precipitation occurred over the two days of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. Data were collected from 7:00 AM to 9:00 AM, 11:00 AM to 1:00 PM, and 4:30 PM to 6:30 PM, respectively for AM, Noon, and PM peak. A summary of the AM, Noon, and PM counts can be found in Table 5-2, Table 5-3, and Table 5-4, respectively.

Table 5-2: AM Bicycle Counts for 1700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	8	-	-	-	-	3	5	-	-	-	8	0
2-Jul-15	6	-	-	-	-	4	2	-	-	-	6	0
Average	7	-	-	-	-	4	4	-	-	-	7	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-3: Noon Bicycle Counts for 1700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	1	-	-	-	-	1	0	-	-	-	1	0
2-Jul-15	4	-	-	-	-	1	3	-	-	-	4	0
Average	3	-	-	-	-	1	2	-	-	-	3	0
Percentage	100%	-	-	-	-	33%	67%	-	-	-	100%	0%

Table 5-4: PM Bicycle Counts for 1700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	1	-	-	-	-	0	1	-	-	-	1	0
2-Jul-15	0	-	-	-	-	0	0	-	-	-	0	0
Average	1	-	-	-	-	0	1	-	-	-	1	0
Percentage	100%	-	-	-	-	0%	100%	-	-	-	100%	0%

5.2.2 Site D2: 2700 South at 1518 West, Syracuse

The second street observed in Davis County was 2700 South in Syracuse. 2700 South 1518 West is the parallel road to 1700 South 1518 West and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 1518 West was a representative location to collect bicycle data on 2700 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 2700 South as a Major Collector. The most recent vehicle traffic volumes for 2700 South were collected in 2013 and were reported to be 1,905 vpd. It was observed that two lanes are present at the site and the posted speed limit is 35 mph. A total of 40 access points were observed along a three block segment between 1200 West and 1800 West. The land use at 2700 South 1518 West is residential. The pavement is made of Hot Mix Asphalt (HMA). The road attributes are summarized in Appendix C. Figure 5-5 provides an image of the site.

Figure 5-5: View of 2700 South at 1518 West, Syracuse (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 2700 South at 1518 West on July 1 and July 2, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected by the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5.5, Table 5.6, and Table 5.7, respectively.

Table 5-5: AM Bicycle Counts for 2700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	21	14	7	8	13	15	4	6	14	1	13	8
2-Jul-15	26	18	8	20	6	11	15	11	15	0	22	4
Average	24	16	8	14	10	13	10	9	15	1	18	6
Percentage	100%	67%	33%	58%	42%	57%	43%	36%	60%	4%	75%	25%

Table 5-6: Noon Bicycle Counts for 2700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	1	1	0	0	1	1	0	0	1	0	0	1
2-Jul-15	7	7	0	6	1	2	5	1	6	0	5	2
Average	4	4	0	3	1	2	3	1	4	0	3	2
Percentage	100%	100%	0%	75%	25%	40%	60%	20%	80%	0%	60%	40%

Table 5-7: PM Bicycle Counts for 2700 South at 1518 West, Syracuse

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	6	6	0	4	2	1	5	1	5	0	5	1
2-Jul-15	4	4	0	1	3	1	3	1	3	0	3	1
Average	5	5	0	3	3	1	4	1	4	0	4	1
Percentage	100%	100%	0%	50%	50%	20%	80%	20%	80%	0%	80%	20%

5.3 Salt Lake County

Eight sites were observed in Salt Lake County as summarized in Table 5-8 and illustrated in Figure 5-6. The details for each of the sites is provided in the following subsections.

Table 5-8: Salt Lake County Sites

Site ID	City	Street	Data Collection Site	Bicycle Infrastructure
SL1	Salt Lake City	Main Street	550 South	Marked Shared Lane
SL2	Salt Lake City	500 East	750 South	Shared Lane
SL3	Salt Lake City	600 East	550 South	Bicycle Boulevard
SL4	Salt Lake City	700 East (SR 71)	550 South	Paved Shoulder
SL5	Sandy	700 East (SR 71)	9662 South	Bike Lane
SL6	Sandy	State Street	9662 South	None
SL7	South Jordan	10600 South	1450 West	Bike Lane
SL8	South Jordan	11400 South	1250 West	Bike Lane

Figure 5-6: Salt Lake County site locations.

5.3.1 Site SL1: Main Street at 550 South, Salt Lake City

The first street observed in Salt Lake County was Main Street in Salt Lake City. Observations were made at the site and it was determined that 550 South was a representative location to collect bicycle data on Main Street. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Main Street as a Major Collector. The most recent vehicle traffic volumes for Main Street were collected in 2013 and were reported to be 6,210 vpd. It was observed that two lanes are present at the site and the posted speed limit is 20 mph. A total of 12 access points were observed along a three block segment between 400 South and

700 South. The land use at Main Street and 550 South is commercial. The pavement is made of PCC. The road attributes are summarized in Appendix C. Figure 5-7 provides an image of the site.

The bicycle infrastructure that is present on Main Street is a Marked Shared Lane as classified by AASHTO (2012). The marked shared lane runs along the center of each lane and is present on both sides of the road and runs north and south. Figure 5-8 provides an image of the bike lane in the southbound direction.

Bicycle data were collected on 550 South at Main Street on August 6, 2015. Only one day of data was collected at this site due to schedule constraints. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the day of data collection. The weather ranged from 60 to 80 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-9, Table 5-10, and Table 5-11, respectively.

Figure 5-7: View of Main Street at 550 South, Salt Lake City (photo taken by Chris Haskell, 2015).

Figure 5-8: Southbound view of the marked shared lane on Main Street at 550 South, Salt Lake City (photo taken by Chris Haskell, 2015).

Table 5-9: AM Bicycle Counts for Main Street at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	Male	Female	Recreation	Commute	NB/EB	SB/WB	Youth	Adult	Senior	Yes	No
6-Aug-15	28	27	1	3	25	17	11	0	28	0	23	5
Average	28	27	1	3	25	17	11	0	28	0	23	5
Percentage	100%	96%	4%	11%	89%	61%	39%	0%	100%	0%	82%	18%

Table 5-10: Noon Bicycle Counts for Main Street at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	Male	Female	Recreation	Commute	NB/EB	SB/WB	Youth	Adult	Senior	Yes	No
6-Aug-15	32	26	6	2	30	13	19	0	32	0	22	10
Average	32	26	6	2	30	13	19	0	32	0	22	10
Percentage	100%	81%	19%	6%	94%	41%	59%	0%	100%	0%	69%	31%

Table 5-11: PM Bicycle Counts for Main Street at 550 South, Salt Lake City

		Gender		Purpose		Direction		Age			Use of Facility	
	Cyclists	Male	Female	Recreation	Commute	NB/EB	SB/WB	Youth	Adult	Senior	Yes	No
6-Aug-15	54	46	8	3	51	23	31	1	53	0	40	14
Average	54	46	8	3	51	23	31	1	53	0	40	14
Percentage	100%	85%	15%	6%	94%	43%	57%	2%	98%	0%	74%	26%

5.3.2 Site SL2: 500 East at 750 South, Salt Lake City

The second street observed in Salt Lake County was 500 East in Salt Lake City. 500 East 750 South is the parallel road to 550 South Main Street and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 750 South was a representative location to collect bicycle data on 500 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon vising the site. UDOT has classified 500 East as a Major Collector. The most recent vehicle traffic volumes for 500 East were collected in 2013 and were reported to be 5,460 vpd. It was observed that four lanes are present at the site and the posted speed limit is 30 mph. A total of 40 access points were observed along a three block segment between 600 South and 900 South. The land use at 500 East 750 South is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-9 provides an image of the site.

The bicycle infrastructure that is present on 500 East is a Shared Lane (No special provisions) as classified by AASHTO (2012). The shared lane is present on both sides of the road and runs north and south. Figure 5-9 provides an image of the shared lane in the southbound direction.

Figure 5-9: Southbound view of the shared lane (no special provisions) on 500 East at 750 South, Salt Lake City (photo taken by Chris Haskell, 2015).

Bicycle data were collected on 500 East at 750 South on July 29 and July 30, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 55 to 85 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-12, Table 5-13, and Table 5-14, respectively.

Table 5-12: AM Bicycle Counts for 500 East at 750 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	21	18	3	3	18	10	11	0	20	1	13	8
30-Jul-15	14	11	3	4	10	11	3	0	14	0	14	0
Average	18	15	3	4	14	11	7	0	17	1	14	4
Percentage	100%	83%	17%	22%	78%	61%	39%	0%	94%	6%	78%	22%

Table 5-13: Noon Bicycle Counts for 500 East at 750 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	24	16	8	15	9	17	7	2	21	1	13	11
30-Jul-15	23	21	2	13	10	12	11	0	23	0	16	7
Average	24	19	5	14	10	15	9	1	22	1	15	9
Percentage	100%	79%	21%	58%	42%	63%	38%	4%	92%	4%	63%	38%

Table 5-14: PM Bicycle Counts for 500 East at 750 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	35	28	7	9	26	13	22	0	33	2	23	12
30-Jul-15	34	23	11	9	24	15	19	2	31	1	21	13
Average	35	26	9	9	25	14	21	1	32	2	22	13
Percentage	100%	74%	26%	26%	74%	40%	60%	3%	91%	6%	63%	37%

5.3.3 Site SL3: 600 East at 550 South, Salt Lake City

The third site observed in Salt Lake County was 600 East in Salt Lake City. Observations were made at the site and it was determined that 550 South was a representative location to collect bicycle data on 600 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 600 East as a Local Road. The most recent vehicle traffic volumes for 600 East were collected in 2012 and were reported to be 5,280 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 26 access points were observed along a three block segment between 400 South and 700 South. The land use at 600 East and 550 South is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-10 provides an image of the site.

Figure 5-10: Southbound view of bicycle boulevard at 600 East at 550 South, Salt Lake City (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on 600 East is a Bicycle Boulevard as classified by AASHTO (2012). The bicycle boulevard is present on both sides of the road and runs north and south. Figure 5-10 provides an image of the bicycle boulevard in the southbound direction.

Bicycle data were collected on 600 East at 550 South on August 3 and August 5, 2015. Weather conditions were poor. Visibility over the two days was poor with the conditions being cloudy. Precipitation occurred over the two days of data collection. The temperature ranged from 60 to 80 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-15, Table 5-16, and Table 5-17, respectively.

Table 5-15: AM Bicycle Counts for 600 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	20	15	5	3	17	16	4	0	20	0	14	6
5-Aug-15	40	28	12	7	33	29	11	1	39	0	35	5
Average	30	22	9	5	25	23	8	1	30	0	25	6
Percentage	100%	71%	29%	17%	83%	74%	26%	3%	97%	0%	81%	19%

Table 5-16: Noon Bicycle Counts for 600 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	10	8	2	3	7	7	3	0	10	0	6	4
5-Aug-15	22	19	2	1	21	16	6	2	20	0	17	5
Average	16	14	2	2	14	12	5	1	15	0	12	5
Percentage	100%	88%	13%	13%	88%	71%	29%	6%	94%	0%	71%	29%

Table 5-17: PM Bicycle Counts for 600 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	33	25	8	7	26	13	20	0	32	1	19	14
5-Aug-15	42	42	0	1	41	22	20	1	39	2	38	4
Average	38	34	4	4	34	18	20	1	36	2	29	9
Percentage	100%	89%	11%	11%	89%	47%	53%	3%	92%	5%	76%	24%

5.3.4 Site SL4: 700 East (SR 71) at 550 South, Salt Lake City

The fourth street observed in Salt Lake County was 700 East in Salt Lake City. 700 East 550 South is the parallel road to 600 East 550 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 550 South was a representative location to collect bicycle data on 700 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 700 East as an Other Principal Arterial. The most recent vehicle traffic volumes for 700 East were collected in 2013 and were reported to be 37,950 vpd. It was observed that six lanes are present at the site and the posted speed limit is 40 mph. A total of 26 access points were observed along a three block segment between 400 South to 700 South. The land use at 700 East 550 South is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-11 provides an image of the site.

Figure 5-11: View of 700 East at 550 South, Salt Lake City (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on 700 East is a Paved Shoulder as classified by AASHTO (2012). The paved shoulder is present on both sides of the road and runs north and south. Figure 5-12 provides an image of the shared lane in the southbound direction.

Figure 5-12: Southbound view of the paved shoulder at 700 East at 550 South, Salt Lake City (photo taken by Chris Haskell, 2015).

Bicycle data were collected on 700 East at 550 South on August 12 and August 13, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being cloudy. No precipitation occurred over the two days of data collection. The temperature ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-18, Table 5-19, and Table 5-20, respectively.

Table 5-18: AM Bicycle Counts for 700 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
12-Aug-15	10	8	2	0	10	5	5	0	10	0	1	9
13-Aug-15	5	4	1	0	5	5	0	0	5	0	2	3
Average	8	6	2	0	8	5	3	0	8	0	2	6
Percentage	100%	75%	25%	0%	100%	63%	38%	0%	100%	0%	25%	75%

Table 5-19: Noon Bicycle Counts for 700 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
12-Aug-15	9	6	3	0	9	5	4	0	9	0	2	7
13-Aug-15	12	9	3	1	11	6	6	0	12	0	7	5
Average	11	8	3	1	10	6	5	0	11	0	5	6
Percentage	100%	73%	27%	9%	91%	55%	45%	0%	100%	0%	45%	55%

Table 5-20: PM Bicycle Counts for 700 East at 550 South, Salt Lake City

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
12-Aug-15	23	19	4	1	22	10	13	3	20	0	8	15
13-Aug-15	21	17	4	1	20	9	12	2	19	0	7	14
Average	22	18	4	1	21	10	13	3	20	0	8	15
Percentage	100%	82%	18%	5%	95%	43%	57%	13%	87%	0%	35%	65%

5.3.5 Site SL5: 700 East (SR 71) at 9662 South, Sandy

The fifth site observed in Salt Lake County was 700 East in Sandy. Observations were made at the site and it was determined that 9662 South was a representative location to collect bicycle data on 700 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 700 East as an Other Principal Arterial. The most recent vehicle traffic volumes for 700 East were collected in 2013 and were reported to be 23,975 vpd. It was observed that four lanes are present at the site and the posted speed limit is 40 mph. A total of 25 access points were observed along a three block segment between 9400 South and Sego Lily Drive. The land use at 700 East and 9662 South is commercial with some residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-13 provides an image of the site.

Figure 5-13: Southbound view of bike lane on 700 East at 9662 South, Sandy (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on 700 East is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs north and south. Figure 5-13 provides an image of the bike lane in the southbound direction.

Bicycle data were collected on 700 East at 9662 South on June 9 and July 28, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 60 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-21, Table 5-22, and Table 5-23, respectively.

Table 5-21: AM Bicycle Counts for 700 East at 9662 South, Sandy

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
9-Jun-15	27	21	6	17	10	15	12	1	24	2	26	1
28-Jul-15	36	28	8	10	26	20	16	2	33	1	30	6
Average	32	25	7	14	18	18	14	2	29	2	28	4
Percentage	100%	78%	22%	44%	56%	56%	44%	6%	88%	6%	88%	13%

Table 5-22: Noon Bicycle Counts for 700 East at 9662 South, Sandy

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
9-Jun-15	17	17	0	6	11	10	7	5	12	0	9	8
28-Jul-15	27	24	3	11	16	12	15	12	13	2	14	13
Average	22	21	2	9	14	11	11	9	13	1	12	11
Percentage	100%	91%	9%	39%	61%	50%	50%	39%	57%	4%	52%	48%

Table 5-23: PM Bicycle Counts for 700 East at 9662 South, Sandy

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
9-Jun-15	31	29	2	14	17	13	18	10	20	1	21	10
28-Jul-15	31	31	0	8	23	13	18	6	25	0	24	7
Average	31	30	1	11	20	13	18	8	23	1	23	9
Percentage	100%	97%	3%	35%	65%	42%	58%	25%	72%	3%	72%	28%

5.3.6 Site SL6: State Street at 9662 South, Sandy

The sixth street observed in Salt Lake County was State Street in Sandy. State Street 9662 South is the parallel road to 700 East 9662 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 9662 South was a representative location to collect bicycle data on State Street. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined when visiting the site. UDOT has classified State Street as an Other Principal Arterial. The most recent vehicle traffic volumes for State Street were collected in 2013 and were reported to be 28,085 vpd. It was observed that six lanes are present at the site and the posted speed limit is 40 mph. A total of 12 access points were observed along a three block segment between 9400 South and Beetdigger Boulevard. The land use at State Street 9662 South is commercial with some residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-14 provides an image of the site.

Figure 5-14: View of State Street at 9662 South, Sandy (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on State Street at 9662 South on July 27 and July 28, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being cloudy. No precipitation occurred over the two days of data collection. The temperature ranged from 56 to 75 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-24, Table 5-25, and Table 5-26, respectively.

Table 5-24: AM Bicycle Counts for State Street at 9662 South, Sandy

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	4	4	0	0	4	2	2	0	4	0	2	2
28-Jul-15	1	1	0	0	1	0	1	0	1	0	0	1
Average	3	3	0	0	3	1	2	0	3	0	1	2
Percentage	100%	100%	0%	0%	100%	33%	67%	0%	100%	0%	33%	67%

Table 5-25: Noon Bicycle Counts for State Street at 9662 South, Sandy

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	5	4	1	3	2	3	2	1	3	1	1	4
28-Jul-15	1	1	0	1	0	1	0	0	1	0	0	1
Average	3	3	1	2	1	2	1	1	2	1	1	3
Percentage	100%	75%	25%	67%	33%	67%	33%	25%	50%	25%	25%	75%

Table 5-26: PM Bicycle Counts for State Street at 9662 South, Sandy

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	9	8	1	5	4	5	4	1	8	0	4	5
28-Jul-15	5	5	0	2	3	2	3	0	5	0	0	5
Average	7	7	1	4	4	4	4	1	7	0	2	5
Percentage	100%	88%	13%	50%	50%	50%	50%	13%	88%	0%	29%	71%

5.3.7 Site SL7: 10600 South at 1450 West, South Jordan

The seventh site observed in Salt Lake County was 10600 South in South Jordan. Observations were made at the site and it was determined that 1450 West was a representative location to collect bicycle data on 10600 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 10600 South as an Other Principal Arterial. The most recent vehicle traffic volumes for 10600 South were collected in 2013 and were reported to be 35,580 vpd. It was observed that four lanes are present at the site address and the posted speed limit is 40 mph. A total of six access points were observed along a three block segment between 1450 West and Redwood Road. The land use at 10600 South and 1450 West is commercial with some residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-15 provides an image of the site.

The bicycle infrastructure that is present on 10600 South is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and travels east and west. Figure 5-16 provides an image of the bike lane in the westbound direction.

Bicycle data were collected on 10600 South at 1450 West on July 20 and July 21, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 70 to 95 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-27, Table 5-28, and Table 5-29, respectively.

Figure 5-15: View of 10600 South at 1450 West, South Jordan (photo taken by Chris Haskell, 2015).

Figure 5-16: Westbound view of the bike lane on 10600 South at 1450 West, South Jordan (photo taken by Chris Haskell, 2015).

Table 5-27: AM Bicycle Counts for 10600 South at 1450 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	4	-	-	-	-	3	1	-	-	-	4	0
21-Jul-15	7	-	-	-	-	5	2	-	-	-	7	0
Average	6	-	-	-	-	4	2	-	-	-	6	0
Percentage	100%	-	-	-	-	67%	33%	-	-	-	100%	0%

Table 5-28: Noon Bicycle Counts for 10600 South at 1450 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	1	-	-	-	-	0	1	-	-	-	1	0
21-Jul-15	3	-	-	-	-	2	1	-	-	-	3	0
Average	2	-	-	-	-	1	1	-	-	-	2	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-29: PM Bicycle Counts for 10600 South at 1450 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	3	-	-	-	-	0	3	-	-	-	3	0
21-Jul-15	9	-	-	-	-	3	6	-	-	-	9	0
Average	6	-	-	-	-	2	5	-	-	-	6	0
Percentage	100%	-	-	-	-	29%	71%	-	-	-	100%	0%

5.3.8 Site SL8: 11400 South at 1250 West, South Jordan

The eighth street observed in Salt Lake County was 11400 South in South Jordan. 11400 South 1250 West is the parallel road to 10600 South 1450 West and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 1250 West was a representative location to collect bicycle data on 11400 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 11400 South as an Other Principal Arterial. The most recent vehicle traffic volumes for 11400 South were collected in 2013 and were reported to be 18,945 vpd. It was observed that four lanes are present at the site address and the posted speed limit is 45 mph. A total of 0 access points were observed along a three blocks segment between 1300 West and South River Front Parkway. The land use at 11400 South 1250 West is residential. The pavement is made of PCC. The road attributes are summarized in Appendix C. Figure 5-17 provides an image of the site.

The bicycle infrastructure that is present on 11400 South is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. Figure 5-18 provides an image of the shared lane in the westbound direction.

Bicycle data were collected on 11400 South at 1250 West on July 22 and July 23, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 70 to 95 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-30, Table 5-31, and Table 5-32, respectively.

Figure 5-17: View of 11400 South at 1250 West, South Jordan (photo taken by Chris Haskell, 2015).

Figure 5-18: Westbound view of the bike lane on 11400 South at 1250 West, South Jordan (photo taken by Chris Haskell, 2015).

Table 5-30: AM Bicycle Counts for 11400 South at 1250 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	8	-	-	-	-	3	5	-	-	-	8	0
23-Jul-15	13	-	-	-	-	6	7	-	-	-	13	0
Average	11	-	-	-	-	5	6	-	-	-	11	0
Percentage	100%	-	-	-	-	45%	55%	-	-	-	100%	0%

Table 5-31: Noon Bicycle Counts for 11400 South at 1250 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	2	-	-	-	-	1	1	-	-	-	2	0
23-Jul-15	2	-	-	-	-	0	2	-	-	-	2	0
Average	2	-	-	-	-	1	2	-	-	-	2	0
Percentage	100%	-	-	-	-	33%	67%	-	-	-	100%	0%

Table 5-32: PM Bicycle Counts for 11400 South 1250 West, South Jordan

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	7	-	-	-	-	0	7	-	-	-	7	0
23-Jul-15	12	-	-	-	-	2	10	-	-	-	12	0
Average	10	-	-	-	-	1	9	-	-	-	10	0
Percentage	100%	-	-	-	-	10%	90%	-	-	-	100%	0%

5.4 Utah County

Twenty-two sites were observed in three cities throughout Utah County as summarized in Table 5-33. Figure 5-19 provides a representation of each of the twenty-two sites within the Utah County area. Data collection details for each of the sites are provided in the following subsections.

Table 5-33: Utah County Sites

Site ID	City	Street	Data Collection Site	Bicycle Infrastructure
U1	Orem	800 North	480 West	Shared Use Path
U2	Orem	400 North	350 West	Bike Lane
U3	Orem	800 South	482 West	Bike Lane
U4	Orem	400 South	480 West	None
U5	Orem	Orem Boulevard	250 North	Bike Lane
U6	Orem	400 West	250 North	None
U7	Provo	University Avenue	Marrcrest East	Shared Use Path
U8	Provo	North Canyon Road	2850 North	None
U9	Provo	Provo River Trail	1720 North	Shared Use Path
U10	Provo	Freedom Boulevard	1720 North	None
U11	Provo	800 North	400 West	Bike Lane
U12	Provo	500 North	400 West	None
U13	Provo	Freedom Boulevard	650 North	Paved Shoulder
U14	Provo	500 West	650 North	None
U15	Provo	Freedom Boulevard	450 South	Bike Lane
U16	Provo	500 West	450 South	None
U17	Provo	Center Street	350 East	Bike Lane
U18	Provo	300 South	350 East	None
U19	Provo	200 East	450 North	Marked Shared Lane
U20	Provo	100 East	450 North	None
U21	Springville	Center Street	300 East	Bike Lane
U22	Springville	100 South	300 East	None

Figure 5-19: Utah County site locations.

5.4.1 Site U1: 800 North at 480 West, Orem

The first site observed in Utah County was 800 North in Orem. Observations were made at the site and it was determined that 480 West was a representative location to collect bicycle data on 800 North. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 800 North as an Other Principal Arterial. The most recent vehicle traffic volume for 800 North were collected in 2013 and were recorded to be 31,560 vpd. It was observed that six lanes are present at the site and the posted speed limit is 45 mph. A total of 3 access points were observed along a three block segment between 300 West and 600 West. The land use at 800

North and 480 West is commercial. The pavement is made of PCC. The road attributes are summarized in Appendix C. Figure 5-20 provides an image of the site.

Figure 5-20:View of 800 North at 480 West, Orem (Google Earth, 2015).

The bicycle infrastructure that is present on 800 North is a Shared Use Path (adjacent to roadways) as classified by AASHTO (2012). The shared use path is present on the north side of the road and runs east and west. The shared use path runs separate from the road. Figure 5-21 provides an image of the bike lane in the eastbound direction.

Bicycle data were collected on 800 North at 480 West on July 27 and July 28, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the two days of data collection. The weather ranged from 60 to 80 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-34, Table 5-35, and Table 5-36, respectively.

Figure 5-21: Eastbound view of shared use path on 800 North at 480 West, Orem (photo taken by Chris Haskell, 2015).

Table 5-34: AM Bicycle Counts for 800 North at 480 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	8	-	-	-	-	2	6	-	-	-	8	0
28-Jul-15	3	-	-	-	-	1	2	-	-	-	3	0
Average	6	-	-	-	-	2	4	-	-	-	6	0
Percentage	100%	-	-	-	-	33%	67%	-	-	-	100%	0%

Table 5-35: Noon Bicycle Counts for 800 North at 480 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	2	-	-	-	-	2	0	-	-	-	2	0
28-Jul-15	6	-	-	-	-	3	3	-	-	-	6	0
Average	4	-	-	-	-	3	2	-	-	-	4	0
Percentage	100%	-	-	-	-	60%	40%	-	-	-	100%	0%

Table 5-36: PM Bicycle Counts for 800 North at 480 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
27-Jul-15	2	-	-	-	-	1	1	-	-	-	2	0
28-Jul-15	5	-	-	-	-	3	2	-	-	-	5	0
Average	4	-	-	-	-	2	2	-	-	-	4	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

5.4.2 Site U2: 400 North at 350 West, Orem

The second site observed in Utah County was 400 North in Orem. 400 North 350 West is the parallel road to 800 North 480 West and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 350 West was a representative location to collect bicycle data on 400 North. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 400 North as a Major Collector. The most recent vehicle traffic volumes for 400 North were collected in 2013 and were recorded to be 8,940 vpd. It was observed that two lanes are present at the site and the posted speed limit is 35 mph. A total of 28 access points were observed along a three blocks segment between 200 West and 500 West. The land use at 400 North 350 West is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-22 provides an image of the site.

Figure 5-22: View of 400 North at 350 West, Orem (Google Earth, 2015).

The bicycle infrastructure that is present on 400 North is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. Bicycle data were collected on 400 North at 350 West on July 29 and July 30, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 55 to 85 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-37, Table 5-38, and Table 5-39, respectively.

Table 5-37: AM Bicycle Counts for 400 North at 350 West, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	12	-	-	-	-	6	6	-	-	-	12	0
30-Jul-15	15	-	-	-	-	7	8	-	-	-	15	0
Average	14	-	-	-	-	7	7	-	-	-	14	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-38: Noon Bicycle Counts for 400 North at 350 West, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	4	-	-	-	-	2	2	-	-	-	4	0
30-Jul-15	3	-	-	-	-	3	0	-	-	-	3	0
Average	4	-	-	-	-	3	1	-	-	-	4	0
Percentage	100%	-	-	-	-	75%	25%	-	-	-	100%	0%

Table 5-39: PM Bicycle Counts for 400 North at 350 West, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jul-15	11	-	-	-	-	4	7	-	-	-	11	0
30-Jul-15	17	-	-	-	-	7	10	-	-	-	17	0
Average	14	-	-	-	-	6	9	-	-	-	14	0
Percentage	100%	-	-	-	-	40%	60%	-	-	-	100%	0%

5.4.3 Site U3: 800 South at 482 West, Orem

The third street observed in Utah County was 800 South in Orem. Observations were made at the site and it was determined that 482 West was a representative location to collect bicycle data on 800 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 800 South as a Minor Arterial. The most recent vehicle traffic volumes for 800 South were collected in 2013 and were recorded to be 7,820 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 34 access points were observed along a three block segment between 300 West and 600 West. The land use at 800 South 482 West is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-23 provides an image of the site.

Figure 5-23: View of 800 South at 482 West, Orem (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on 800 South is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. The bike lane runs along the road with a shoulder separating the bike lane from the sidewalk thus providing vehicle parking. Figure 5-24 provides an image of the bike lane in the westbound direction.

Figure 5-24: Westbound view of the bike lane on 800 South at 482 West, Orem (photo taken by Chris Haskell, 2015).

Bicycle data were collected on 800 South at 482 West on July 13 and July 14, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the two days of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-40, Table 5-41, and Table 5-42, respectively.

Table 5-40: AM Bicycle Counts for 800 South at 482 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	8	-	-	-	-	5	3	-	-	-	8	0
14-Jul-15	9	-	-	-	-	5	4	-	-	-	9	0
Average	9	-	-	-	-	5	4	-	-	-	9	0
Percentage	100%	-	-	-	-	56%	44%	-	-	-	100%	0%

Table 5-41: Noon Bicycle Counts for 800 South at 482 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	9	-	-	-	-	3	6	-	-	-	9	0
14-Jul-15	5	-	-	-	-	4	1	-	-	-	5	0
Average	7	-	-	-	-	4	4	-	-	-	7	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-42: PM Bicycle Counts for 800 South at 482 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	13	-	-	-	-	10	3	-	-	-	13	0
14-Jul-15	11	-	-	-	-	6	5	-	-	-	11	0
Average	12	-	-	-	-	8	4	-	-	-	12	0
Percentage	100%	-	-	-	-	67%	33%	-	-	-	100%	0%

5.4.4 Site U4: 400 South at 482 West, Orem

The fourth street observed in Utah County was 400 South in Orem. 400 South 482 West is the parallel road to 800 South 482 West and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 482 West was a representative location to collect bicycle data on 400 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 400 South as a Major Collector. The most recent vehicle traffic volumes for 400 South were collected in 2013 and were recorded to be 4,485 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 11 access points were observed along a three block segment between 300 West and 600 West. The land use at 400 South 482 West is residential with some commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-25 provides an image of the site.

Figure 5-25: View of 400 South at 482 West, Orem (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 400 South at 482 West on July 13 and July 14, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being cloudy. No precipitation occurred over the two days of data collection. The temperature ranged from 80 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-43, Table 5-44, and Table 5-45, respectively.

Table 5-43: AM Bicycle Counts for 400 South at 482 West, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	20	12	8	11	9	8	12	9	11	0	17	3
14-Jul-15	18	14	4	6	12	7	11	1	17	0	17	1
Average	19	13	6	9	11	8	12	5	14	0	17	2
Percentage	100%	68%	32%	45%	55%	40%	60%	26%	74%	0%	89%	11%

Table 5-44: Noon Bicycle Counts for 400 South at 482 West, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	5	4	1	1	4	3	2	1	4	0	3	2
14-Jul-15	19	14	5	8	11	11	8	13	6	0	5	14
Average	12	9	3	5	8	7	5	7	5	0	4	8
Percentage	100%	75%	25%	38%	62%	58%	42%	58%	42%	0%	33%	67%

Table 5-45: PM Bicycle Counts for 400 South at 482 West, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	24	21	3	8	16	8	16	10	14	0	15	9
14-Jul-15	10	10	0	4	6	7	3	2	8	0	8	2
Average	17	16	2	6	11	8	10	6	11	0	12	6
Percentage	100%	89%	11%	35%	65%	44%	56%	35%	65%	0%	67%	33%

5.4.5 Site U5: Orem Boulevard at 250 North, Orem

The fifth street observed in Utah County was Orem Boulevard in Orem. Observations were made at the site and it was determined that 250 North was a representative location to collect bicycle data on Orem Boulevard. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Orem Boulevard as a Major Collector. The most recent vehicle traffic volumes for Orem Boulevard were collected in 2013 and were recorded to be 7,795 vpd. It was observed that two lanes are present at the site and the posted speed limit is 35 mph. A total of 10 access points were observed along a three block segment between 100 North and 400 North. The land use at Orem Boulevard 250 North is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-26 provides an image of the site.

Figure 5-26: View of Orem Boulevard at 250 North, Orem (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on Orem Boulevard is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs north and south. The bike lane runs along the road with no shoulder separating the bike lane from the sidewalk. Figure 5-27 provides an image of the bike lane in the northbound direction.

Bicycle data were collected on Orem Boulevard at 250 North on July 13 and July 14, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the two days of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-46, Table 5-47, and Table 5-48, respectively.

Weekend data was collected for this site in addition to weekday data. A summary of the AM, Noon, and PM counts can be found in Table 5-49, Table 5-50, and Table 5-51, respectively.

Figure 5-27: Northbound view of the bike lane on Orem Boulevard at 250 North, Orem (photo taken by Chris Haskell, 2015).

Table 5-46: AM Bicycle Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jul-15	4	-	-	-	-	2	2	-	-	-	4	0
16-Jul-15	8	-	-	-	-	4	4	-	-	-	8	0
Average	6	-	-	-	-	3	3	-	-	-	6	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-47: Noon Bicycle Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jul-15	4	-	-	-	-	2	2	-	-	-	4	0
16-Jul-15	1	-	-	-	-	1	0	-	-	-	1	0
Average	3	-	-	-	-	2	1	-	-	-	3	0
Percentage	100%	-	-	-	-	67%	33%	-	-	-	100%	0%

Table 5-48: PM Bicycle Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jul-15	4	-	-	-	-	2	2	-	-	-	4	0
16-Jul-15	8	-	-	-	-	5	3	-	-	-	8	0
Average	6	-	-	-	-	4	3	-	-	-	6	0
Percentage	100%	-	-	-	-	57%	43%	-	-	-	100%	0%

Table 5-49: AM Weekend Bicycle Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jul-15	5	-	-	-	-	2	3	-	-	-	5	0
18-Jul-15	3	-	-	-	-	0	3	-	-	-	3	0
Average	4	-	-	-	-	1	3	-	-	-	4	0
Percentage	100%	-	-	-	-	25%	75%	-	-	-	100%	0%

Table 5-50: Noon Weekend Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jul-15	1	-	-	-	-	0	1	-	-	-	1	0
18-Jul-15	1	-	-	-	-	1	0	-	-	-	1	0
Average	1	-	-	-	-	1	1	-	-	-	1	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-51: PM Weekend Counts for Orem Boulevard at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jul-15	5	-	-	-	-	3	2	-	-	-	5	0
18-Jul-15	2	-	-	-	-	0	2	-	-	-	2	0
Average	4	-	-	-	-	2	2	-	-	-	4	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

5.4.6 Site U6: 400 West at 250 North, Orem

The sixth street observed in Utah County was 400 West in Orem. 400 West 250 North is the parallel road to Orem Boulevard 250 North and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 250 North was the best location to collect bicycle data on 400 West. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 400 West as a Major Collector. The most recent vehicle traffic volumes for 400 West were collected in 2013 and were recorded to be 7,485 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 36 access points were observed along a three block segment between 100 North and 400 North. The land use at 400 West 250 North is residential with some commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-28 provides an image of the site.

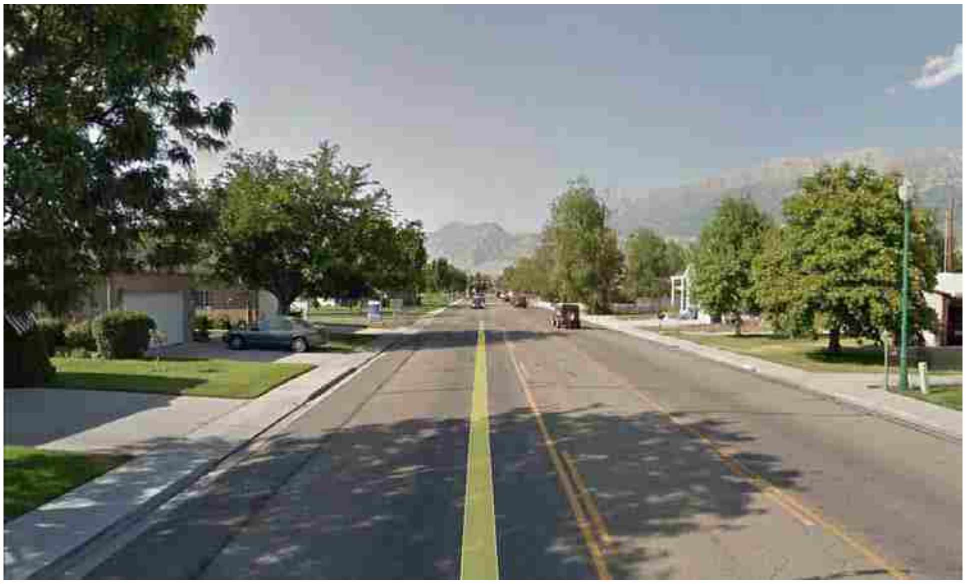

Figure 5-28: View of 400 West at 250 North, Orem (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 400 West at 250 North on August 11 and August 12, 2015. Weather conditions were fair. Visibility over the two days was fair with the conditions being cloudy. No precipitation occurred over the two days of data collection. The temperature ranged from 69 to 91 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-52, Table 5-53, and Table 5-54, respectively.

Table 5-52: AM Bicycle Counts for 400 West at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Aug-15	15	12	3	6	9	7	8	2	12	1	15	0
12-Aug-15	19	13	6	8	11	9	10	2	15	2	17	2
Average	17	13	5	7	10	8	9	2	14	2	16	1
Percentage	100%	72%	28%	41%	59%	47%	53%	11%	78%	11%	94%	6%

Table 5-53: Noon Bicycle Counts for 400 West at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Aug-15	8	6	2	4	4	3	5	2	6	0	4	4
12-Aug-15	16	15	1	12	4	8	8	9	7	0	8	8
Average	12	11	2	8	4	6	7	6	7	0	6	6
Percentage	100%	85%	15%	67%	33%	46%	54%	46%	54%	0%	50%	50%

Table 5-54: PM Bicycle Counts for 400 West at 250 North, Orem

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Aug-15	17	16	1	8	9	6	11	5	12	0	10	7
12-Aug-15	7	4	3	2	5	4	3	1	6	0	5	2
Average	12	10	2	5	7	5	7	3	9	0	8	5
Percentage	100%	83%	17%	42%	58%	42%	58%	25%	75%	0%	62%	38%

5.4.7 Site U7: University Avenue at Marrcrest East, Provo

The seventh street observed in Utah County was University Avenue in Provo. Observations were made at the site and it was determined that Marrcrest East was a representative location to collect bicycle data on University Avenue. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were not determined because of the type of bicycle infrastructure.

The bicycle infrastructure that is present on University Avenue is a Shared Use Path (Adjacent to Roadways) as classified by AASHTO (2012). The shared use path is present on one side of the road and runs north and south. Figure 5-29 provides an image of the shared use path in the northbound direction.

Figure 5-29: Soutbound view of the shared use path on University Avenue at Marrcrest East, Provo (photo taken by Chris Haskell, 2015).

Bicycle data were collected on University Avenue at Marrcrest East on July 6 and July 7, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the two days of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-55, Table 5-56, and Table 5-57, respectively.

Table 5-55: AM Bicycle Counts for University Avenue at Marrcrest East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	27	-	-	-	-	16	11	-	-	-	27	0
7-Jul-15	27	-	-	-	-	16	11	-	-	-	27	0
Average	27	-	-	-	-	16	11	-	-	-	27	0
Percentage	100%	-	-	-	-	59%	41%	-	-	-	100%	0%

Table 5-56: Noon Bicycle Counts for University Avenue at Marrcrest East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	15	-	-	-	-	11	4	-	-	-	15	0
7-Jul-15	25	-	-	-	-	20	5	-	-	-	25	0
Average	20	-	-	-	-	16	5	-	-	-	20	0
Percentage	100%	-	-	-	-	76%	24%	-	-	-	100%	0%

Table 5-57: PM Bicycle Counts for University Avenue at Marrcrest East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	34	-	-	-	-	16	18	-	-	-	34	0
7-Jul-15	36	-	-	-	-	16	20	-	-	-	36	0
Average	35	-	-	-	-	16	19	-	-	-	35	0
Percentage	100%	-	-	-	-	46%	54%	-	-	-	100%	0%

5.4.8 Site U8: North Canyon Road at 2850 North, Provo

The eighth street observed in Utah County was North Canyon Road in Provo. North Canyon Road 2850 North is the parallel road to University Avenue Marrcrest East and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 2850 North was a representative location to collect bicycle data on North Canyon Road. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified North Canyon Road as a Minor Arterial. The most recent vehicle traffic volumes for North Canyon Road were collected in 2013 and were recorded to be 8,220 vpd. It was observed that two lanes are present at the site address and the posted speed limit is 35 mph. A total of 16 access points were observed along a three block segment between 2700 North and 3000 North. The land use at North Canyon Road 2850 North is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-30 provides an image of the site.

Figure 5-30: View of North Canyon Road at 2850 North, Provo (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on North Canyon Road at 2850 North on July 6 and July 7, 2015. Weather conditions were good. Visibility over the two days was good with the conditions being clear. No precipitation occurred over the two days of data collection. The temperature ranged from 80 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-58, Table 5-59, and Table 5-60, respectively.

Table 5-58: AM Bicycle Counts for North Canyon Road at 2850 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	18	14	4	11	7	8	10	1	17	0	18	0
7-Jul-15	17	13	4	7	10	4	13	1	15	1	17	0
Average	18	14	4	9	9	6	12	1	16	1	18	0
Percentage	100%	78%	22%	50%	50%	33%	67%	6%	89%	6%	100%	0%

Table 5-59: Noon Bicycle Counts for North Canyon Road at 2850 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	10	6	4	4	6	2	8	3	7	0	7	3
7-Jul-15	5	4	1	1	4	1	4	1	4	0	5	0
Average	8	5	3	3	5	2	6	2	6	0	6	2
Percentage	100%	63%	38%	38%	63%	25%	75%	25%	75%	0%	75%	25%

Table 5-60: PM Bicycle Counts for North Canyon Road at 2850 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	12	11	2	4	9	8	2	0	12	0	12	0
7-Jul-15	16	15	1	5	11	10	6	1	15	0	16	0
Average	14	13	2	5	10	9	4	1	14	0	14	0
Percentage	100%	87%	13%	33%	67%	69%	31%	7%	93%	0%	100%	0%

5.4.9 Site U9: Provo River Trail at 1720 North, Provo

A shared use path was observed in Utah County called the Provo River Trail. Observations were made at the site and it was determined that 1720 North was a representative location to collect bicycle data on the Provo River Trail. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were not determined because of the type of bicycle infrastructure.

The bicycle infrastructure that is present on the Provo River Trail is a Shared Use Path (Independent right-of-way) as classified by AASHTO (2012). The shared use path does not run along a road but travels predominantly in a north and south direction. Figure 5-31 provides an image of the shared use path in the southbound direction.

Bicycle data were collected on Provo River Trail at 1720 North on July 6, 2015. Only one day of data was collected due to tampered equipment by unknown parties. Weather conditions were fair. Visibility was good with the conditions being clear. No precipitation occurred during the day of data collection. The weather ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method.

A summary of the AM, Noon, and PM counts can be found in Table 5-61, Table 5-62, and Table 5-63, respectively.

Figure 5-31: Southbound view of the Provo River Trail at 1720 North, Provo (photo taken by Chris Haskell, 2015).

Table 5-61: AM Bicycle Counts for Provo River Trail at 1720 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	23	-	-	-	-	13	10	-	-	-	23	0
Average	23	-	-	-	-	13	10	-	-	-	23	0
Percentage	100%	-	-	-	-	57%	43%	-	-	-	100%	0%

Table 5-62: Noon Bicycle Counts for Provo River Trail at 1720 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	13	-	-	-	-	5	8	-	-	-	13	0
Average	13	-	-	-	-	5	8	-	-	-	13	0
Percentage	100%	-	-	-	-	38%	62%	-	-	-	100%	0%

Table 5-63: PM Bicycle Counts for Provo River Trail at 1720 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	32	-	-	-	-	12	20	-	-	-	32	0
Average	32	-	-	-	-	12	20	-	-	-	32	0
Percentage	100%	-	-	-	-	38%	63%	-	-	-	100%	0%

5.4.10 Site U10: Freedom Boulevard at 1720 North, Provo

The tenth site observed in Utah County was Freedom Boulevard in Provo. Freedom Boulevard 1720 North is the parallel road to Provo River Trail 1720 North and was observed to provide a comparison between the two facilities. Observations were made at the site and it was determined that 1720 North was a representative location to collect bicycle data on Freedom Boulevard. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Freedom Boulevard as a Minor Arterial. The most recent vehicle traffic volumes for Freedom Boulevard were collected in 2013 and were recorded to be 13,725 vpd. It was observed that four lanes are present at the site and the posted speed limit is 35 mph. A total of 14 access points were observed along a three block segment between 1570 North and 1870 North. The land use at Freedom Boulevard 1720 North is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-32 provides an image of the site.

No bicycle infrastructure exists at this site. Bicycle data were collected on Freedom Boulevard at 1720 North on July 6 and July 7, 2015. Weather conditions were fair. Visibility over the two days was fair with the conditions being mostly cloudy. No precipitation occurred over the two days of data collection. The temperature ranged from 70 to 85 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method.

A summary of the AM, Noon, and PM counts can be found in Table 5-64, Table 5-65, and Table 5-66, respectively.

Figure 5-32: View of Freedom Boulevard at 1720 North, Provo (Google Earth, 2015).

Table 5-64: AM Bicycle Counts for Freedom Boulevard at 1720 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	10	7	3	5	5	5	4	0	10	0	6	4
7-Jul-15	10	7	3	3	7	6	4	0	10	0	5	5
Average	10	7	3	4	6	6	4	0	10	0	6	5
Percentage	100%	70%	30%	40%	60%	60%	40%	0%	100%	0%	55%	45%

Table 5-65: Noon Bicycle Counts for Freedom Boulevard at 1720 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	9	6	3	5	4	5	4	0	9	0	4	5
7-Jul-15	8	7	1	2	6	2	6	0	8	0	4	4
Average	9	7	2	4	5	4	5	0	9	0	4	5
Percentage	100%	78%	22%	44%	56%	44%	56%	0%	100%	0%	44%	56%

Table 5-66: PM Bicycle Counts for Freedom Boulevard at 1720 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
6-Jul-15	25	22	3	9	16	12	13	6	18	1	9	16
7-Jul-15	24	21	3	6	18	17	7	1	22	1	13	11
Average	25	22	3	8	17	15	10	4	20	1	11	14
Percentage	100%	88%	12%	32%	68%	60%	40%	16%	80%	4%	44%	56%

5.4.11 Site U11: 800 North at 400 West, Provo

The eleventh street observed in Utah County was 800 North in Provo. Observations were made at the site and it was determined that 400 West was a representative location to collect bicycle data on 800 North. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 800 North as a Minor Arterial. The most recent vehicle traffic volumes for 800 North were collected in 2013 and were recorded to be 10,320 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 17 access points were observed along a three block segment between 250 West and 550 West. The land use at 800 North 400 West is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-33 provides an image of the site.

The bicycle infrastructure that is present on 800 North is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. The bike lane runs along the road with a shoulder separating the bike lane from the sidewalk thus providing vehicle parking. Figure 5-34 provides an image of the bike lane in the eastbound direction.

Figure 5-33: View of 800 North at 400 West, Provo (photo taken by Chris Haskell, 2015).

Figure 5-34: Eastbound view of the bike lane on 800 North at 400 West, Provo (photo taken by Chris Haskell, 2015).

Bicycle data were collected on 800 North at 400 West on June 15 and June 16, 2015. Weather conditions were fair. Visibility over the two days was good with the conditions being clear. No precipitation occurred during the two days of data collection. The weather ranged from 75 to 95 degrees Fahrenheit during the peak periods. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-67, Table 5-68, and Table 5-69, respectively.

Table 5-67: AM Bicycle Counts for 800 North at 400 West, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jun-15	37	-	-	-	-	27	10	-	-	-	37	0
16-Jun-15	41	-	-	-	-	33	8	-	-	-	41	0
Average	39	-	-	-	-	30	9	-	-	-	39	0
Percentage	100%	-	-	-	-	77%	23%	-	-	-	100%	0%

Table 5-68: Noon Bicycle Counts for 800 North at 400 West, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jun-15	19	-	-	-	-	8	11	-	-	-	19	0
16-Jun-15	9	-	-	-	-	2	7	-	-	-	9	0
Average	14	-	-	-	-	5	9	-	-	-	14	0
Percentage	100%	-	-	-	-	36%	64%	-	-	-	100%	0%

Table 5-69: PM Bicycle Counts for 800 North at 400 West, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
15-Jun-15	31	-	-	-	-	5	26	-	-	-	31	0
16-Jun-15	41	-	-	-	-	9	32	-	-	-	41	0
Average	36	-	-	-	-	7	29	-	-	-	36	0
Percentage	100%	-	-	-	-	19%	81%	-	-	-	100%	0%

5.4.12 Site U12: 500 North at 400 West, Provo

The twelfth site observed in Utah County was 500 North in Provo. 500 North 400 West is the parallel road to 800 North 400 West and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 400 West was a representative location to collect bicycle data on 500 North. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 500 North as a Major Collector. The most recent vehicle traffic volumes for 500 North were collected in 2013 and were recorded to be 8,870 vpd. It was observed that two lanes are present at the site and posted speed limit is 25 mph. A total of 11 access points were observed along a three block segment between 250 West and 550 West. The land use at 500 North 400 West is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-35 provides an image of the site.

Figure 5-35: View of 500 North at 400 West, Provo (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 500 North at 400 West on August 3 and August 4, 2015. Weather conditions were fair. August 3 was cloudy with some rain. August 4 was clear with no precipitation. The temperature ranged from 60 to 80 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-70, Table 5-71, and Table 5-72, respectively.

Table 5-70: AM Bicycle Counts for 500 North at 400 West, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	7	4	3	2	5	3	4	0	7	0	2	5
4-Aug-15	10	8	2	1	9	6	4	1	9	0	8	2
Average	9	6	3	2	7	5	4	1	8	0	5	4
Percentage	100%	67%	33%	22%	78%	56%	44%	11%	89%	0%	56%	44%

Table 5-71: Noon Bicycle Counts for 500 North at 400 West, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	15	12	3	0	14	8	7	5	10	0	4	11
4-Aug-15	17	9	8	2	15	6	11	3	14	0	6	11
Average	16	11	6	1	15	7	9	4	12	0	5	11
Percentage	100%	65%	35%	6%	94%	44%	56%	25%	75%	0%	31%	69%

Table 5-72: PM Bicycle Counts for 500 North at 400 West, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
3-Aug-15	19	13	6	1	18	9	10	1	18	0	4	15
4-Aug-15	16	13	3	0	16	7	9	0	14	2	4	12
Average	18	13	5	1	17	8	10	1	16	1	4	14
Percentage	100%	72%	28%	6%	94%	44%	56%	6%	89%	6%	22%	78%

5.4.13 Site U13: Freedom Boulevard at 650 North, Provo

The thirteenth street observed in Utah County was Freedom Boulevard in Provo. Observations were made at the site and it was determined that 650 North was a representative location to collect bicycle data on Freedom Boulevard. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Freedom Boulevard as a Minor Arterial. The most recent vehicle traffic volumes for Freedom Boulevard were collected in 2013 and were recorded to be 16,070 vpd. It was observed that four lanes are present at the site and the posted speed limit is 35 mph. A total of nine access points were observed along a three block segment between 500 North and 800 North. The land use at Freedom Boulevard 650 North is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-36 provides an image of the site.

Figure 5-36: View of Freedom Boulevard at 650 North, Provo (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on Freedom Boulevard is a Paved Shoulder as classified by AASHTO (2012). The paved shoulder is present on both sides of the road and travels north and south.

Bicycle data were collected on Freedom Boulevard at 650 North on June 11 and July 27, 2015. Weather conditions were fair. June 11 was cloudy with some rain. Temperature ranged from 70 to 80 degrees Fahrenheit. July 27 was clear with no precipitation. Temperature ranged from 80 to 90 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-73, Table 5-74, and Table 5-75, respectively.

Table 5-73: AM Bicycle Counts for Freedom Boulevard at 650 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Jun-15	20	18	2	0	20	16	4	2	18	0	12	8
27-Jul-15	28	25	3	5	23	17	11	0	28	0	19	9
Average	24	22	3	3	22	17	8	1	23	0	16	9
Percentage	100%	88%	12%	12%	88%	68%	32%	4%	96%	0%	64%	36%

Table 5-74: Noon Bicycle Counts for Freedom Boulevard at 650 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Jun-15	16	13	3	0	16	8	8	1	15	0	5	11
27-Jul-15	13	9	4	0	13	7	6	1	12	0	3	10
Average	15	11	4	0	15	8	7	1	14	0	4	11
Percentage	100%	73%	27%	0%	100%	53%	47%	7%	93%	0%	27%	73%

Table 5-75: PM Bicycle Counts for Freedom Boulevard at 650 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
11-Jun-15	32	26	6	2	30	18	14	4	28	0	15	17
27-Jul-15	40	34	6	3	37	18	22	1	39	0	18	22
Average	36	30	6	3	34	18	18	3	34	0	17	20
Percentage	100%	83%	17%	8%	92%	50%	50%	8%	92%	0%	46%	54%

5.4.14 Site U14: 500 West at 650 North, Provo

The fourteenth site observed in Utah County was 500 West in Provo. 500 West 650 North is the parallel road to Freedom Boulevard 650 North and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 650 North was a representative location to collect bicycle data on 500 West. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 500 West as an Other Principal Arterial. The most recent vehicle traffic volumes for 500 West were collected in 2013 and were recorded to be 30,545 vpd. It was observed that four lanes are present at the site and the posted speed limit is 30 mph. A total of 15 access points were observed along a three block segment between 500 North and 800 North. The land use at 500 West 650 North is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-37 provides an image of the site.

Figure 5-37: View of 500 West at 650 North, Provo (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 500 West at 650 North on July 22 and July 23, 2015. Weather conditions were fair. Both days were partly cloudy with no precipitation. The temperature ranged from 65 to 85 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-76, Table 5-77, and Table 5-78, respectively.

Table 5-76: AM Bicycle Counts for 500 West at 650 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	21	17	5	4	17	12	9	0	20	1	7	14
23-Jul-15	43	24	19	30	13	32	11	0	32	5	25	18
Average	32	21	12	17	15	22	10	0	26	3	16	16
Percentage	100%	64%	36%	53%	47%	69%	31%	0%	90%	10%	50%	50%

Table 5-77: Noon Bicycle Counts for 500 West at 650 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	17	14	3	5	12	7	10	3	11	3	2	15
23-Jul-15	18	14	4	8	10	9	9	3	13	2	4	14
Average	18	14	4	7	11	8	10	3	12	3	3	15
Percentage	100%	78%	22%	39%	61%	44%	56%	17%	67%	17%	17%	83%

Table 5-78: PM Bicyle Counts for 500 West at 650 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
22-Jul-15	23	17	6	7	16	9	14	3	19	1	5	18
23-Jul-15	34	22	12	12	22	14	20	5	29	0	3	31
Average	29	20	9	10	19	12	17	4	24	1	4	25
Percentage	100%	69%	31%	34%	66%	41%	59%	14%	83%	3%	14%	86%

5.4.15 Site U15: Freedom Boulevard at 450 South, Provo

The fifteenth site observed in Utah County was Freedom Boulevard in Provo. Observations were made at the site and it was determined that 450 South was a representative location to collect bicycle data on Freedom Boulevard. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Freedom Boulevard as a Major Collector. The most recent vehicle traffic volumes for Freedom Boulevard were collected in 2013 and were recorded to be 6,945 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 17 access points were observed along a three block segment between 300 South and 600 South. The land use at Freedom Boulevard 450 South is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-38 provides an image of the site.

Figure 5-38: View of Freedom Boulevard at 450 South, Provo (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on Freedom Boulevard is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs north and south. The bike lane runs along the road and is separated from the sidewalk by a shoulder. Shoulder parking is available for vehicles.

Bicycle data were collected on Freedom Boulevard at 450 South on July 8 and July 9, 2015. Weather conditions were fair. Both days produced clear skies and no precipitation. Temperature was from 70 to 90 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-79, Table 5-80, and Table 5-81, respectively.

Table 5-79: AM Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	25	-	-	-	-	10	15	-	-	-	25	0
9-Jul-15	33	-	-	-	-	16	17	-	-	-	33	0
Average	29	-	-	-	-	13	16	-	-	-	29	0
Percentage	100%	-	-	-	-	45%	55%	-	-	-	100%	0%

Table 5-80: Noon Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	18	-	-	-	-	8	10	-	-	-	18	0
9-Jul-15	21	-	-	-	-	11	10	-	-	-	21	0
Average	20	-	-	-	-	10	10	-	-	-	20	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-81: PM Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	27	-	-	-	-	20	7	-	-	-	27	0
9-Jul-15	23	-	-	-	-	14	9	-	-	-	23	0
Average	25	-	-	-	-	17	8	-	-	-	25	0
Percentage	100%	-	-	-	-	68%	32%	-	-	-	100%	0%

Weekend bicycle data were collected at Freedom Boulevard 450 South on July 10 and July 11, 2015. Weather conditions were fair. Both days produced clear skies and no precipitation. Temperatures ranged from 70 to 90 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-82, Table 5-83, and Table 5-84, respectively.

Table 5-82: AM Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
10-Jul-15	16	-	-	-	-	3	13	-	-	-	16	0
11-Jul-15	9	-	-	-	-	5	4	-	-	-	9	0
Average	13	-	-	-	-	4	9	-	-	-	13	0
Percentage	100%	-	-	-	-	31%	69%	-	-	-	100%	0%

Table 5-83: Noon Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
10-Jul-15	12	-	-	-	-	6	6	-	-	-	12	0
11-Jul-15	27	-	-	-	-	18	9	-	-	-	27	0
Average	20	-	-	-	-	12	8	-	-	-	20	0
Percentage	100%	-	-	-	-	60%	40%	-	-	-	100%	0%

Table 5-84: PM Weekend Bicycle Counts for Freedom Boulevard at 450 South, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
10-Jul-15	31	-	-	-	-	25	6	-	-	-	31	0
11-Jul-15	17	-	-	-	-	11	6	-	-	-	17	0
Average	24	-	-	-	-	18	6	-	-	-	24	0
Percentage	100%	-	-	-	-	75%	25%	-	-	-	100%	0%

5.4.16 Site U16: 500 West at 450 South, Provo

The sixteenth site observed in Utah County was 500 West in Provo. 500 West 450 South is the parallel road to Freedom Boulevard 450 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 450 South was a representative location to collect bicycle data on 500 West. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 500 West as a Minor Arterial. The most recent vehicle traffic volumes for 500 West were collected in 2013 and were recorded to be 7,425 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 23 access points were observed along a three block segment between 300 South and 600 South. The land use at 500 West 450 South is residential and commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-39 provides an image of the site.

No bicycle infrastructure exists at this site. Bicycle data were collected on 500 West at 450 South on July 8 and July 9, 2015. Weather conditions were fair. Both days were partly cloudy with no precipitation. The temperature ranged from 70 to 90 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-85, Table 5-86, and Table 5-87, respectively.

Figure 5-39: View of 500 West at 450 South, Provo (Google Earth, 2015).

Table 5-85: AM Bicycle Counts for 500 West at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	5	4	1	0	5	2	3	0	5	0	1	4
9-Jul-15	6	5	1	0	6	3	3	0	6	0	5	1
Average	6	5	1	0	6	3	3	0	6	0	3	3
Percentage	100%	83%	17%	0%	100%	50%	50%	0%	100%	0%	50%	50%

Table 5-86: Noon Bicycle Counts for 500 West at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	6	4	2	1	5	4	2	0	6	0	4	2
9-Jul-15	6	4	2	0	6	4	2	1	5	0	2	4
Average	6	4	2	1	6	4	2	1	6	0	3	3
Percentage	100%	67%	33%	14%	86%	67%	33%	14%	86%	0%	50%	50%

Table 5-87: PM Bicycle Counts for 500 West at 450 South, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	16	13	3	0	16	9	7	4	12	0	7	9
9-Jul-15	11	10	1	0	11	5	6	1	10	0	4	7
Average	14	12	2	0	14	7	7	3	11	0	6	8
Percentage	100%	86%	14%	0%	100%	50%	50%	21%	79%	0%	43%	57%

5.4.17 Site U17: Center Street at 350 East, Provo

The seventeenth site observed in Utah County was Center Street in Provo. Observations were made at the site and it was determined that 350 East was a representative location to collect bicycle data on Center Street. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Center Street as a Minor Arterial. The most recent vehicle traffic volumes for Freedom Boulevard were collected in 2013 and were recorded to be 6,780 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 26 access points were observed along a three block segment between 200 East and 500 East. The land use at Center Street 350 East is residential with some commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-40 provides an image of the site.

Figure 5-40: View of Center Street at 350 East, Provo (Google Earth, 2015).

The bicycle infrastructure that is present on Center Street is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west. The bike lane runs along the road and is separated from the sidewalk by a shoulder. Shoulder parking is available for vehicles.

Bicycle data were collected on Center Street at 350 East on July 17 and July 18, 2015. Weather conditions were fair. Both days produced clear skies and no precipitation. The temperature ranged from 70 to 90 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-88, Table 5-89, and Table 5-90, respectively.

Table 5-88: AM Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jun-15	21	-	-	-	-	2	19	-	-	-	21	0
18-Jun-15	21	-	-	-	-	2	19	-	-	-	21	0
Average	21	-	-	-	-	2	19	-	-	-	21	0
Percentage	100%	-	-	-	-	10%	90%	-	-	-	100%	0%

Table 5-89: Noon Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jun-15	13	-	-	-	-	3	10	-	-	-	13	0
18-Jun-15	15	-	-	-	-	4	11	-	-	-	15	0
Average	14	-	-	-	-	4	11	-	-	-	14	0
Percentage	100%	-	-	-	-	27%	73%	-	-	-	100%	0%

Table 5-90: PM Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
17-Jun-15	18	-	-	-	-	12	6	-	-	-	18	0
18-Jun-15	6	-	-	-	-	2	4	-	-	-	6	0
Average	12	-	-	-	-	7	5	-	-	-	12	0
Percentage	100%	-	-	-	-	58%	42%	-	-	-	100%	0%

Weekend bicycle data were collected at Center Street 350 East on July 19 and July 20, 2015. Weather conditions were fair. Both days produced clear skies and no precipitation. Temperatures ranged from 70 to 90 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-91, Table 5-92, and Table 5-93, respectively.

Table 5-91: AM Weekend Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
19-Jun-15	21	-	-	-	-	2	19	-	-	-	21	0
20-Jun-15	8	-	-	-	-	2	6	-	-	-	8	0
Average	15	-	-	-	-	2	13	-	-	-	15	0
Percentage	100%	-	-	-	-	13%	87%	-	-	-	100%	0%

Table 5-92: Noon Weekend Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
19-Jun-15	6	-	-	-	-	4	2	-	-	-	6	0
20-Jun-15	12	-	-	-	-	3	9	-	-	-	12	0
Average	9	-	-	-	-	4	6	-	-	-	9	0
Percentage	100%	-	-	-	-	40%	60%	-	-	-	100%	0%

Table 5-93: PM Weekend Bicycle Counts for Center Street at 350 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
19-Jun-15	16	-	-	-	-	7	9	-	-	-	16	0
20-Jun-15	2	-	-	-	-	1	1	-	-	-	2	0
Average	9	-	-	-	-	4	5	-	-	-	9	0
Percentage	100%	-	-	-	-	44%	56%	-	-	-	100%	0%

5.4.18 Site U18: 300 South at 330 East, Provo

The eighteenth site observed in Utah County was 300 South in Provo. 300 South 330 East is the parallel road to Center Street 330 East and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 330 East was a representative location to collect bicycle data on 300 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 300 South as an Other Principal Arterial. The most recent vehicle traffic volumes for 300 South were collected in 2013 and were recorded to be 13,615 vpd. It was observed that four lanes are present at the site and the posted speed limit is 35 mph. A total of 23 access points were observed along a three block segment between 170 East and 470 East. The land use at 300 South 330 East is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-41 provides an image of the site.

Figure 5-41: View of 300 South at 330 East, Provo (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 300 South at 330 East on August 4 and August 5, 2015. Weather conditions were fair. Both days were partly cloudy with no precipitation. The temperature ranged from 60 to 87 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-94, Table 5-95, and Table 5-96, respectively.

Table 5-94: AM Bicycle Counts for 300 South at 330 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
4-Aug-15	8	7	1	4	4	4	4	0	7	1	4	4
5-Aug-15	7	6	1	4	3	2	5	0	7	0	3	4
Average	8	7	1	4	4	3	5	0	7	1	4	4
Percentage	100%	88%	13%	50%	50%	38%	63%	0%	88%	13%	50%	50%

Table 5-95: Noon Bicycle Counts for 300 South at 330 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
4-Aug-15	11	8	3	7	4	5	6	3	7	1	5	6
5-Aug-15	6	4	2	3	3	3	3	0	6	0	1	5
Average	9	6	3	5	4	4	5	2	7	1	3	6
Percentage	100%	67%	33%	56%	44%	44%	56%	20%	70%	10%	33%	67%

Table 5-96: PM Bicycle Counts for 300 South at 330 East, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
4-Aug-15	11	10	1	5	6	7	4	1	9	1	3	8
5-Aug-15	16	11	5	10	6	8	8	1	14	1	2	14
Average	14	11	3	8	6	8	6	1	12	1	3	11
Percentage	100%	79%	21%	57%	43%	57%	43%	7%	86%	7%	21%	79%

5.4.19 Site U19: 200 East at 450 North, Provo

The nineteenth site observed in Utah County was 200 East in Provo. Observations were made at the site and it was determined that 450 North was a representative location to collect bicycle data on 200 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 200 East as a Local Road. No AADT data were available for this site according the UDOT. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 20 access points were observed along a three block segment between 300 North and 600 North. The land use at 200 East 450 North is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-42 provides an image of the site.

Figure 5-42: View of 200 East at 450 North, Provo (Google Earth, 2015).

The bicycle infrastructure that is present on 200 East is a Marked Shared Lane as classified by AASHTO (2012). The marked shared lane is present on both sides of the road and runs north and south.

Bicycle data were collected on 200 East at 450 North on June 16 and June 18, 2015. Weather conditions were good. Both days produced clear skies and no precipitation. Temperatures ranged from 70 to 90 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-97, Table 5-98, and Table 5-99, respectively.

Table 5-97: AM Bicycle Counts for 200 East at 450 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
16-Jun-15	24	17	7	2	22	18	6	0	24	0	24	0
18-Jun-15	21	13	9	0	22	18	4	0	21	0	21	0
Average	23	15	8	1	22	18	5	0	23	0	23	0
Percentage	100%	65%	35%	4%	96%	78%	22%	0%	100%	0%	100%	0%

Table 5-98: Noon Bicycle Counts for 200 East at 450 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
16-Jun-15	23	17	6	4	19	13	10	2	21	0	20	3
18-Jun-15	20	7	13	2	18	14	6	0	20	0	19	1
Average	22	12	10	3	19	14	8	1	21	0	20	2
Percentage	100%	55%	45%	14%	86%	64%	36%	5%	95%	0%	91%	9%

Table 5-99: PM Bicycle Counts for 200 East at 450 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
16-Jun-15	23	14	9	3	20	11	12	0	23	0	22	1
18-Jun-15	26	19	7	5	21	12	14	0	26	0	24	2
Average	25	17	8	4	21	12	13	0	25	0	23	2
Percentage	100%	68%	32%	16%	84%	48%	52%	0%	100%	0%	92%	8%

5.4.20 Site U20: 100 East at 450 North, Provo

The twentieth site observed in Utah County was 100 East in Provo. 100 East 450 North is the parallel road to 200 East 450 North and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 450 North was a representative location to collect bicycle data on 100 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 100 East as a Local Road. No AADT data were available for this site according to UDOT due to the road being classified as Local. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 19 access points were observed along a three block segment between 300 North and 600

North. The land use at 100 East 450 North is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-43 provides an image of the site.

Figure 5-43: View of 100 East at 450 North, Provo (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 100 East at 450 North on July 20 and July 21, 2015. Weather conditions were fair. July 20 was cloudy with rain. July 21 was cloudy with no precipitation. The temperature ranged from 65 to 85 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-100, Table 5-101, and Table 5-102, respectively.

Table 5-100: AM Bicycle Counts for 100 East at 450 North, Provo

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	13	8	5	7	6	7	6	0	13	0	13	0
21-Jul-15	16	11	5	4	12	7	9	0	16	0	16	0
Average	15	10	5	6	9	7	8	0	15	0	15	0
Percentage	100%	67%	33%	40%	60%	47%	53%	0%	100%	0%	100%	0%

Table 5-101: Noon Bicycle Counts for 100 East at 450 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	8	5	3	4	4	1	7	1	7	0	7	1
21-Jul-15	10	7	2	5	5	3	7	0	10	0	9	1
Average	9	6	3	5	5	2	7	1	9	0	8	1
Percentage	100%	67%	33%	50%	50%	22%	78%	10%	90%	0%	89%	11%

Table 5-102: PM Bicycle Counts for 100 East at 450 North, Provo

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
20-Jul-15	22	17	6	6	16	11	11	0	22	0	21	1
21-Jul-15	30	21	9	12	18	11	19	0	30	0	30	0
Average	26	19	8	9	17	11	15	0	26	0	26	1
Percentage	100%	70%	30%	35%	65%	42%	58%	0%	100%	0%	96%	4%

5.4.21 Site U21: Center Street at 300 East, Springville

The twenty-first site observed in Utah County was Center Street in Springville. Observations were made at the site and it was determined that 300 East was a representative location to collect bicycle data on Center Street. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Center Street as a Major Collector. The most recent vehicle traffic volumes for Center Street were collected in 2013 and were recorded to be 6,305 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 26 access points were observed along a three block segment between 150 East and 450 East. The land use at Center Street 300 East is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-44 provides an image of the site.

Figure 5-44: View of Center Street at 300 East, Springville (Google Earth, 2015).

The bicycle infrastructure that is present on Center Street is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and runs east and west.

Bicycle data were collected on Center Street at 300 East on July 8 and July 9, 2015. Weather conditions were fair. Both days produced cloudy skies and no precipitation. Temperatures ranged from 65 to 80 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-103, Table 5-104, and Table 5-105, respectively.

Table 5-103: AM Bicycle Counts for Center Street at 300 East, Springville

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	13	10	3	12	1	5	8	1	10	2	13	0
9-Jul-15	9	7	2	5	4	3	6	1	8	0	9	0
Average	11	9	3	9	3	4	7	1	9	1	11	0
Percentage	100%	75%	25%	75%	25%	36%	64%	9%	82%	9%	100%	0%

Table 5-104: Noon Bicycle Counts for Center Street at 300 East, Springville

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	5	4	1	3	2	1	4	3	2	0	3	2
9-Jul-15	9	3	6	8	1	2	7	6	3	0	7	2
Average	7	4	4	6	2	2	6	5	3	0	5	2
Percentage	100%	50%	50%	75%	25%	25%	75%	63%	38%	0%	71%	29%

Table 5-105: PM Bicycle Counts for Center Street at 300 East, Springville

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
8-Jul-15	5	5	0	3	2	4	1	1	4	0	3	2
9-Jul-15	14	9	5	9	5	9	5	6	8	0	13	1
Average	10	7	3	6	4	7	3	4	6	0	8	2
Percentage	100%	70%	30%	60%	40%	70%	30%	40%	60%	0%	80%	20%

5.4.22 Site U22: 100 South at 300 East, Springville

The twenty second site observed in Utah County was 100 South in Springville. 100 South 300 East is the parallel road to Center Street 300 East and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 300 East was a representative location to collect bicycle data on 100 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 100 South as a Local Road. No AADT data were available for this site according to UDOT due to the road being classified as Local. It was observed that two lanes are present at the site and posted speed limit is 25 mph. A total of 25 access points were observed along a three block segment between 150 East and 450 East. The land use at 100 South 300 East is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-45 provides an image of the site.

Figure 5-45: View of 100 South at 300 East, Springville (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 100 South at 300 East on July 13 and July 14, 2015. Weather conditions were fair. Both days produced partly cloudy skies and no precipitation. The temperature ranged from 65 to 87 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-106, Table 5-107, and Table 5-108, respectively.

Table 5-106: AM Bicycle Counts for 100 South at 300 East, Springville

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	1	1	0	0	1	1	0	0	1	0	1	0
14-Jul-15	1	1	0	0	1	1	0	0	1	0	1	0
Average	1	1	0	0	1	1	0	0	1	0	1	0
Percentage	100%	100%	0%	0%	100%	100%	0%	0%	100%	0%	100%	0%

Table 5-107: Noon Bicycle Counts for 100 South at 300 East, Springville

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	5	5	0	4	1	1	4	5	0	0	3	2
14-Jul-15	1	1	0	1	0	0	1	0	1	0	1	0
Average	3	3	0	3	1	1	3	3	1	0	2	1
Percentage	100%	100%	0%	75%	25%	25%	75%	75%	25%	0%	67%	33%

Table 5-108: PM Bicycle Counts for 100 South at 300 East, Springville

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
13-Jul-15	3	3	0	3	0	1	2	1	2	0	3	0
14-Jul-15	2	2	0	1	1	2	0	2	0	0	2	0
Average	3	3	0	2	1	2	1	2	1	0	3	0
Percentage	100%	100%	0%	67%	33%	67%	33%	67%	33%	0%	100%	0%

5.5 Washington County

Five sites were observed in Washington County as summarized in Table 5-109 and illustrated in Figure 5-46. The details for each of the sites are provided in the following subsections.

Table 5-109: Washington County Sites

Site ID	City	Street	Data Collection Site	Bicycle Infrastructure
WA1	St. George	700 East	150 South	Paved Shoulder
WA2	St. George	600 East	150 South	None
WA3	St. George	400 East	350 South	Paved Shoulder
WA4	St. George	300 South	650 East	Bike Lane
WA5	St. George	400 South	650 East	None

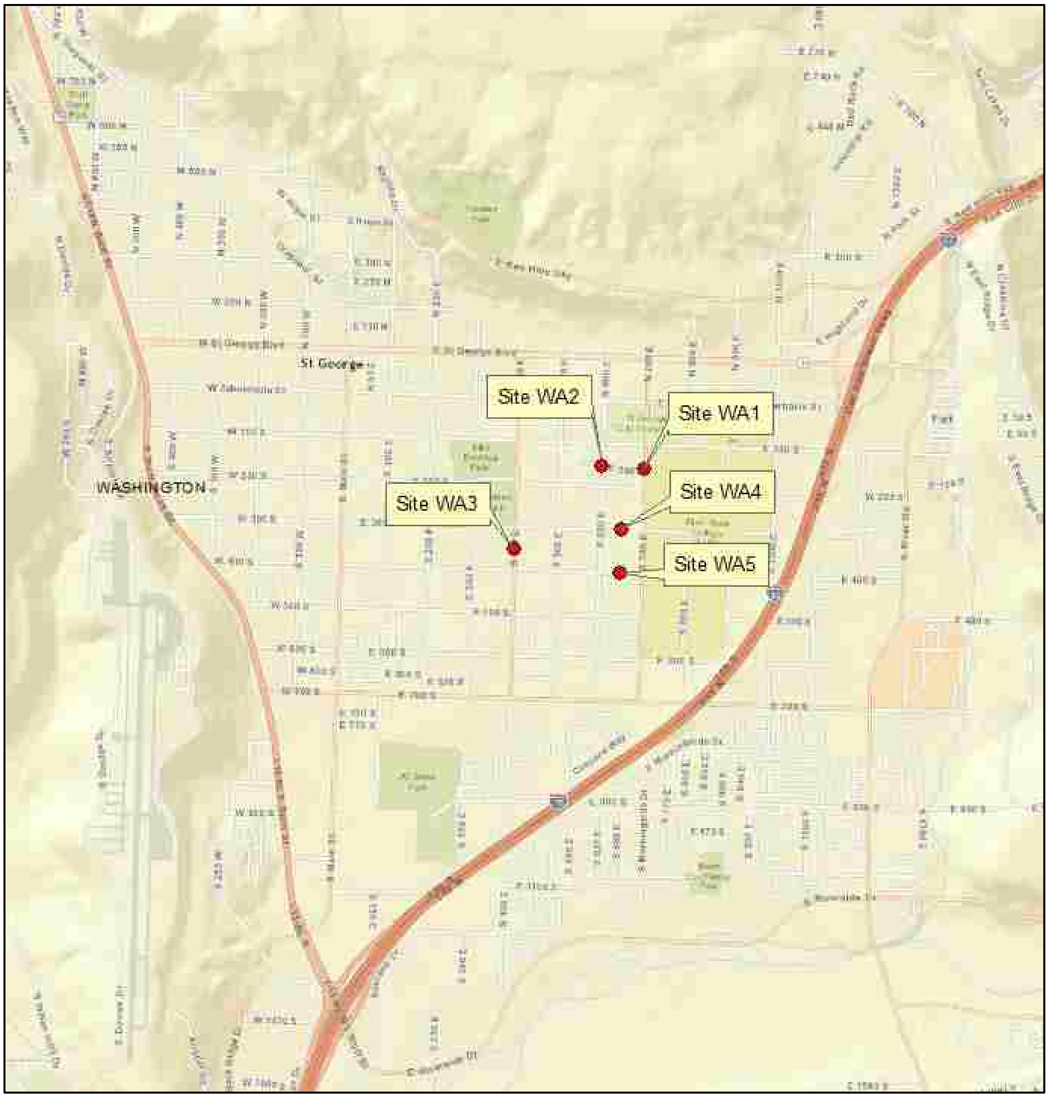

Figure 5-46: Washington County site locations.

5.5.1 Site WA1: 700 East at 150 South, St. George

The first site observed in Washington County was 700 East in St. George. Observations were made at the site and it was determined that 150 South was a representative location to collect bicycle data on 700 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 700 East as a Major Collector. The most recent vehicle traffic volumes for 700 East were collected in 2013 were recorded to be 9,910 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 16 access points were observed along a three block segment between Center Street and 300 South. The land use at 700 East 150 South is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-47 provides an image of the site.

Figure 5-47: View of 700 East at 150 South, St. George (Google Earth, 2015).

The bicycle infrastructure that is present on 700 East is a Paved Shoulder as classified by AASHTO (2012). The paved shoulder is present on the southbound side of the road and travels north and south. The paved shoulder runs along the street on the southbound side only.

Bicycle data were collected on 700 East at 150 South on June 24, 2015. One day of data was collected at this site. Weather conditions were fair with clear skies and no precipitation. The temperature ranged from 75 to 100 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-110, Table 5-111, and Table 5-112, respectively.

Table 5-110: AM Bicycle Counts for 700 East at 150 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	2	1	1	2	0	1	1	0	2	0	1	1
Average	2	1	1	2	0	1	1	0	2	0	1	1
Percentage	100%	50%	50%	100%	0%	50%	50%	0%	100%	0%	50%	50%

Table 5-111: Noon Bicycle Counts for 700 East at 150 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Percentage	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5-112: PM Bicycle Counts for 700 East at 150 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	4	4	0	3	1	2	2	0	2	2	1	3
Average	4	4	0	3	1	2	2	0	2	2	1	3
Percentage	100%	100%	0%	75%	25%	50%	50%	0%	50%	50%	25%	75%

5.5.2 Site WA2: 600 East at 150 South, St. George

The second site observed in Washington County was 600 East in St. George. 600 East 150 South is the parallel road to 700 East 150 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 150 South was a representative location to collect bicycle data on 600 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 600 East as a Local Road. No AADT data were available for this site according to UDOT and St. George city due to the road being classified as Local. It was observed that two lanes are present at the site address and the posted speed limit is 25 mph. A total of 27 access points were observed along a three block segment between Center Street and 300 South. The land use at 600 East 150 South is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-48 provides an image of the site.

Figure 5-48: View of 600 East at 150 South, St. George (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on 600 East at 150 South on June 24, 2015. Only one day of data was collected. Weather conditions were fair. June 24 was clear with no precipitation. The temperature ranged from 75 to 100 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-113, Table 5-114, and Table 5-115, respectively.

Table 5-113: AM Bicycle Counts for 600 East at 150 South, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	2	2	0	0	2	2	0	0	2	0	1	1
Average	2	2	0	0	2	2	0	0	2	0	1	1
Percentage	100%	100%	0%	0%	100%	100%	0%	0%	100%	0%	50%	50%

Table 5-114: Noon Bicycle Counts for 600 East at 150 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	2	2	0	0	2	2	0	0	2	0	0	2
Average	2	2	0	0	2	2	0	0	2	0	0	2
Percentage	100%	100%	0%	0%	100%	100%	0%	0%	100%	0%	0%	100%

Table 5-115: PM Bicycle Counts for 600 East at 150 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
24-Jun-15	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Percentage	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

5.5.3 Site WA3: 400 East at 350 South, St. George

The third site observed in Washington County was 400 East in St. George. Observations were made at the site and it was determined that 350 South was a representative location to collect bicycle data on 400 East. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 400 East as a Major Collector. The most recent vehicle traffic volumes for 400 East were collected in 2013 and were recorded to be 5,500 vpd. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 34 access points were observed along a three block segment between 200 South and 500 South. The land use at 400 East 350 South is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-49 provides an image of the site.

Figure 5-49: View of 400 East at 350 South, St. George (Google Earth, 2015).

The bicycle infrastructure that is present on 400 East is a Paved Shoulder as classified by AASHTO (2012). The paved shoulder is present on both sides of the road and travels north and south. The paved shoulder runs along both sides of the street.

Bicycle data were collected on 400 East at 350 South on June 23, 2015. Only one day of data was collected at this site. Weather conditions were fair, with clear skies and no precipitation. Temperatures ranged from 75 to 100 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-116, Table 5-117, and Table 5-118, respectively.

Table 5-116: AM Bicycle Counts for 400 East at 350 South, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	7	7	0	5	2	6	1	0	7	0	5	2
Average	7	7	0	5	2	6	1	0	7	0	5	2
Percentage	100%	100%	0%	71%	29%	86%	14%	0%	100%	0%	71%	29%

Table 5-117: Noon Bicycle Counts for 400 East at 350 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	Male	Female	Recreation	Commute	NB/EB	SB/WB	Youth	Adult	Senior	Yes	No
23-Jun-15	2	1	1	0	2	0	2	0	1	1	0	2
Average	2	1	1	0	2	0	2	0	1	1	0	2
Percentage	100%	50%	50%	0%	100%	0%	100%	0%	50%	50%	0%	100%

Table 5-118: PM Bicycle Counts for 400 East at 350 South, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	Male	Female	Recreation	Commute	NB/EB	SB/WB	Youth	Adult	Senior	Yes	No
23-Jun-15	6	5	1	4	2	4	2	0	3	3	5	1
Average	6	5	1	4	2	4	2	0	3	3	5	1
Percentage	100%	83%	17%	67%	33%	67%	33%	0%	50%	50%	83%	17%

5.5.4 Site WA4: 300 South at 650 East, St. George

The fourth site observed in Washington County was 300 South in St. George. Observations were made at the site and it was determined that 650 East was a representative location to collect bicycle data on 300 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 300 South as a Local Road. No AADT data were available according to UDOT and St. George City due to the road being classified as Local. It was observed that two lanes are present at the site and the posted speed limit is 25 mph. A total of 28 access points were observed along a three block segment between 500 East and 800 East. The land use at 300 South 650 East is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-50 provides an image of the site.

The bicycle infrastructure that is present on 300 South is a Bike Lane as classified by AASHTO (2012). The bike lane is present on both sides of the road and travels east and west. The bike lane runs along the street and is separated from the sidewalk by vehicle parking.

Figure 5-50: View of 300 South at 650 East, St. George (Google Earth, 2015).

Bicycle data were collected on 300 South at 650 East on June 23 and June 24, 2015. Weather conditions were fair, clear skies and no precipitation. The temperatures ranged from 75 to 100 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-119, Table 5-120, and Table 5-121, respectively.

Table 5-119: AM Bicycle Counts for 300 South at 650 East, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	5	-	-	-	-	5	0	-	-	-	5	0
24-Jun-15	9	-	-	-	-	5	4	-	-	-	9	0
Average	7	-	-	-	-	5	2	-	-	-	7	0
Percentage	100%	-	-	-	-	71%	29%	-	-	-	100%	0%

Table 5-120: Noon Bicycle Counts for 300 South at 650 East, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	0	-	-	-	-	0	0	-	-	-	0	0
24-Jun-15	2	-	-	-	-	1	1	-	-	-	2	0
Average	1	-	-	-	-	1	1	-	-	-	1	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-121: PM Bicycle Counts for 300 South at 650 East, St. George

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	2	-	-	-	-	2	0	-	-	-	2	0
24-Jun-15	0	-	-	-	-	0	0	-	-	-	0	0
Average	1	-	-	-	-	1	0	-	-	-	1	0
Percentage	100%	-	-	-	-	100%	0%	-	-	-	100%	0%

5.5.5 Site WA5: 400 South at 650 East, St. George

The fifth site observed in Washington County was 400 South in St. George. 400 South 650 East is the parallel road to 300 South 650 East and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 650 East was a representative location to collect bicycle data on 400 South. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified 400 South as a Local Road. No AADT data were available for this site according to UDOT and St. George City due to the road being classified as Local. It was observed that two lanes are present at the site and posted speed limit is 25 mph. A total of 29 access points were observed along a three block segment between 500 East and 800 East. The land use at 400 South 650 East is residential. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-51 provides an image of the site.

No bicycle infrastructure exists at this site. Bicycle data were collected on 400 South at 650 East on June 23, 2015. One day of data was collected. Weather conditions were fair, clear with no precipitation. The temperatures ranged from 75 to 100 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-122, Table 5-123, and Table 5-124, respectively.

Figure 5-51: View of 400 South at 650 East, St. George (Google Earth, 2015).

Table 5-122: AM Bicycle Counts for 400 South at 650 East, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	1	1	0	0	1	1	0	0	1	0	1	0
Average	1	1	0	0	1	1	0	0	1	0	1	0
Percentage	100%	100%	0%	0%	100%	100%	0%	0%	100%	0%	100%	0%

Table 5-123: Noon Bicycle Counts for 400 South at 650 East, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	1	1	0	0	1	0	1	0	1	0	1	0
Average	1	1	0	0	1	0	1	0	1	0	1	0
Percentage	100%	100%	0%	0%	100%	0%	100%	0%	100%	0%	100%	0%

Table 5-124: PM Bicycle Counts for 400 South at 650 East, St. George

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
23-Jun-15	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Percentage	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

5.6 Weber County

Four sites were observed in Weber County as summarized in Table 5-125and illustrated in Figure 5-52. The details for each of the sites are provided in the following subsections.

Table 5-125: Weber County Sites

Site ID	City	Street	Data Collection Site	Bicycle Infrastructure
WE1	Ogden	Grant Avenue	2125 South	Protected Bike Lane
WE2	Ogden	Lincoln Avenue	2125 South	None
WE3	Ogden	Grant Avenue	2550 South	Paved Shoulder
WE4	Ogden	Lincoln Avenue	2550 South	None

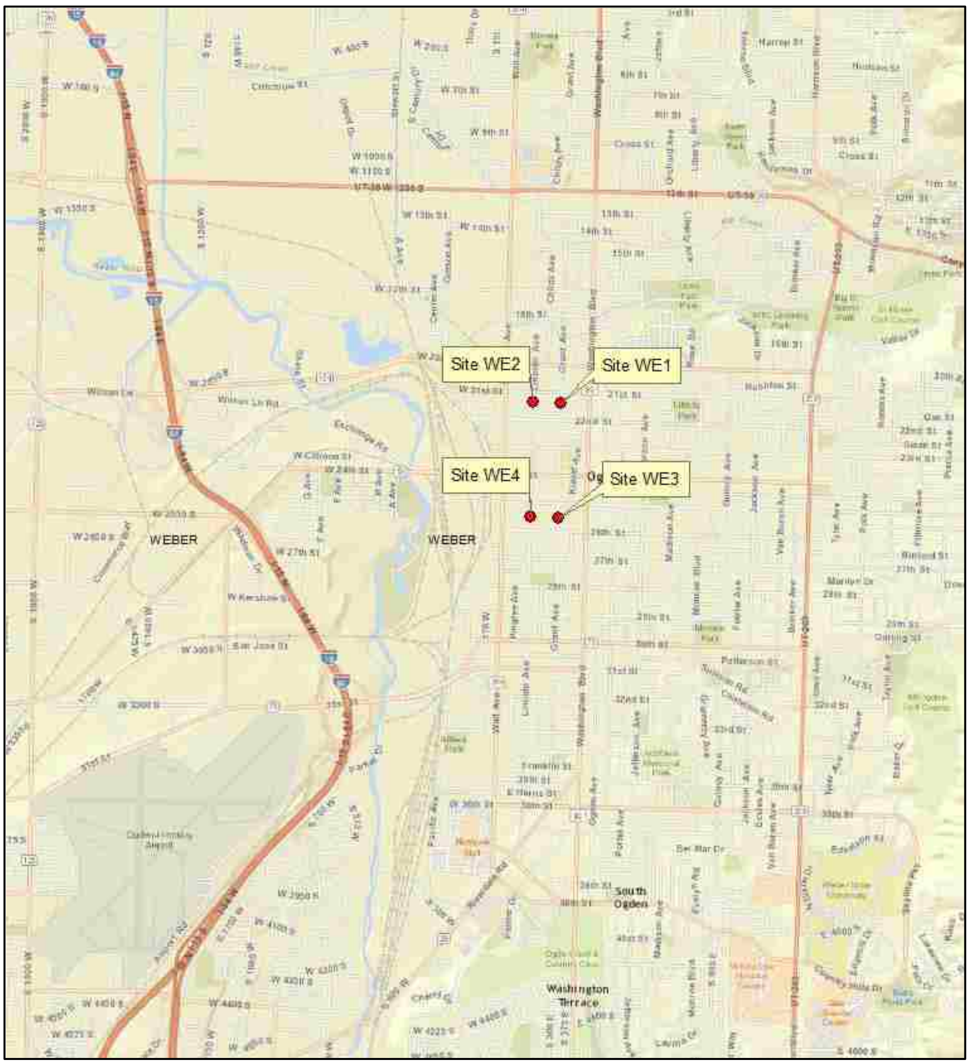

Figure 5-52: Weber County site locations.

5.6.1 Site WE1: Grant Avenue at 2125 South, Ogden

The first site observed in Weber County was Grant Avenue in Ogden. Observations were made at the site and it was determined that 2125 South was a representative location to collect bicycle data on Grant Avenue. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Grant Avenue as a Major Collector. The most recent vehicle traffic volumes for Grant Avenue were collected in 2013 and were recorded to be 3,105 vpd. It was observed that two lanes are present at the site and the posted speed limit is 20 mph. A total of 9 access points were observed along a three block segment between 1975 South and 2275 South. The land use at Grant Avenue 2125 South is commercial. The pavement is made of PCC. The road attributes are summarized in Appendix C. Figure 5-53 provides an image of the site.

The bicycle infrastructure that is present on Grant Avenue is a Protected Bike Lane as classified by AASHTO (2012). The protected bike lane is present on the both sides of the road and extends north and south. The protected bike lane runs along the street.

Figure 5-53: View of Grant Ave at 2125 South, Ogden (photo taken by Chris Haskell, 2015).

Bicycle data were collected on Grant Avenue at 2125 South on June 29 and June 30, 2015. Weather conditions were fair, clear skies and no precipitation. The temperature ranged from 75 to 95 degrees Fahrenheit. Bicycle data were collected using the automatic count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-126, Table 5-127, and Table 5-128, respectively.

Table 5-126: AM Bicycle Counts for Grant Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	5	-	-	-	-	3	2	-	-	-	5	0
30-Jun-15	5	-	-	-	-	2	3	-	-	-	5	0
Average	5	-	-	-	-	3	3	-	-	-	5	0
Percentage	100%	-	-	-	-	50%	50%	-	-	-	100%	0%

Table 5-127: Noon Bicycle Counts for Grant Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	8	-	-	-	-	5	3	-	-	-	8	0
30-Jun-15	9	-	-	-	-	4	5	-	-	-	9	0
Average	9	-	-	-	-	5	4	-	-	-	8.5	0
Percentage	100%	-	-	-	-	56%	44%	-	-	-	100%	0%

Table 5-128: PM Bicycle Counts for Grant Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*		*Age*			*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	10	-	-	-	-	7	3	-	-	-	10	0
30-Jun-15	22	-	-	-	-	16	6	-	-	-	22	0
Average	16	-	-	-	-	12	5	-	-	-	16	0
Percentage	100%	-	-	-	-	71%	29%	-	-	-	100%	0%

5.6.2 Site WE2: Lincoln Avenue at 2125 South, Ogden

The second site observed in Weber County was Lincoln Avenue in Ogden. Lincoln Avenue 2125 South is the parallel road to Grant Avenue 2125 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 2125 South was a representative location to collect bicycle data on Lincoln

Avenue. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Lincoln Avenue as a Major Collector. The most recent vehicles traffic volumes for Lincoln Avenue were collected in 2013 and were recorded to be 4,375 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 19 access points were observed along a three block segment between 1975 South and 2275 South. The land use at Lincoln Avenue 2125 South is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-54 provides an image of the site.

Figure 5-54: View of Lincoln Ave at 2125 South, Ogden (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on Lincoln Avenue at 2125 South on June 29 and June 30, 2015. Weather conditions were fair. Both days were partly cloudy and no precipitation. The temperature ranged from 75 to 100 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-129, Table 5-130, and Table 5-131, respectively.

Table 5-129: AM Bicycle Counts for Lincoln Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	10	7	3	9	1	7	3	0	10	0	2	8
30-Jun-15	11	11	0	2	9	5	6	1	8	2	6	5
Average	11	9	2	6	5	6	5	1	9	1	4	7
Percentage	100%	82%	18%	55%	45%	55%	45%	9%	82%	9%	36%	64%

Table 5-130: Noon Bicycle Counts for Lincoln Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	11	11	0	4	7	6	5	0	9	2	2	9
30-Jun-15	6	5	1	5	1	6	0	0	6	0	3	3
Average	9	8	1	5	4	6	3	0	8	1	3	6
Percentage	100%	89%	11%	56%	44%	67%	33%	0%	89%	11%	33%	67%

Table 5-131: PM Bicycle Counts for Lincoln Avenue at 2125 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	7	6	1	6	1	6	1	2	5	0	0	7
30-Jun-15	14	11	3	9	5	10	4	0	12	2	4	10
Average	11	9	2	8	3	8	3	1	9	1	2	9
Percentage	100%	82%	18%	73%	27%	73%	27%	9%	82%	9%	18%	82%

5.6.3 Site WE3: Grant Avenue at 2550 South, Ogden

The third site observed in Weber County was Grant Avenue in Ogden. Observations were made at the site and it was determined that 2550 South was a representative location to collect bicycle data on Grant Avenue. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Grant Avenue as a Major Collector. The most recent vehicle traffic volumes for Grant Avenue were collected in 2013 and were recorded to be 3,320 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 24 access points were observed along a three block segment between 2400 South and 2700 South. The land use at Grant Avenue 2550 South is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-55 provides an image of the site.

Figure 5-55: View of Grant Ave at 2550 South, Ogden (photo taken by Chris Haskell, 2015).

The bicycle infrastructure that is present on Grant Avenue is a Paved Shoulder as classified by AASHTO (2012). The paved shoulder is present on both sides of the road and travels north and south. The paved shoulder runs along the street. Parking is available on both sides of the street

Bicycle data were collected on Grant Avenue at 2550 South on June 29 and June 30, 2015. Weather conditions were fair, clear skies and no precipitation. The temperature ranged from 75 to 95 degrees Fahrenheit. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-132, Table 5-133, and Table 5-134, respectively.

Table 5-132: AM Bicycle Counts for Grant Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	9	6	3	1	8	4	5	0	9	0	5	4
30-Jun-15	13	10	3	3	10	5	8	0	13	0	6	7
Average	11	8	3	2	9	5	7	0	11	0	6	6
Percentage	100%	73%	27%	18%	82%	42%	58%	0%	100%	0%	50%	50%

Table 5-133: Noon Bicycle Counts for Grant Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	6	5	1	0	6	2	4	1	5	0	4	2
30-Jun-15	8	6	2	3	5	6	2	2	6	0	6	2
Average	7	6	2	2	6	4	3	2	6	0	5	2
Percentage	100%	75%	25%	25%	75%	57%	43%	25%	75%	0%	71%	29%

Table 5-134: PM Bicycle Counts for Grant Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
29-Jun-15	17	16	1	6	11	10	7	3	14	0	9	8
30-Jun-15	11	8	3	1	10	6	5	0	11	0	5	6
Average	14	12	2	4	11	8	6	2	13	0	7	7
Percentage	100%	86%	14%	27%	73%	57%	43%	13%	87%	0%	50%	50%

5.6.4 Site WE4: Lincoln Avenue at 2550 South, Ogden

The fourth site observed in Weber County was Lincoln Avenue in Ogden. Lincoln Avenue 2550 South is the parallel road to Grant Avenue 2550 South and was observed to provide a comparison between the two roads. Observations were made at the site and it was determined that 2550 South was a representative location to collect bicycle data on Lincoln Avenue. The classification, AADT, lanes, posted speed limit, segment length, access points, land use, and pavement of the road were determined upon visiting the site. UDOT has classified Lincoln Avenue as a Major Collector. The most recent vehicle traffic volumes for Lincoln Avenue were collected in 2013 and were recorded to be 3,695 vpd. It was observed that two lanes are present at the site and the posted speed limit is 30 mph. A total of 29 access points were observed along a three block segment between 2400 South and 2700 South. The land use at Lincoln Avenue 2550 South is commercial. The pavement is made of HMA. The road attributes are summarized in Appendix C. Figure 5-56 provides an image of the site.

Figure 5-56: View of Lincoln Ave at 2550 South, Ogden (Google Earth, 2015).

No bicycle infrastructure exists at this site. Bicycle data were collected on Lincoln Avenue at 2550 South on July 1 and July 2, 2015. Weather conditions were fair. Both days were partly cloudy and no precipitation. The temperature ranged from 80 to 97 degrees Fahrenheit during the peak periods. Bicycle data were collected using the manual count research method. A summary of the AM, Noon, and PM counts can be found in Table 5-135, Table 5-136, and Table 5-137, respectively.

Table 5-135: AM Bicycle Counts for Lincoln Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	10	8	2	4	6	5	5	0	9	1	2	8
2-Jul-15	5	4	1	1	4	2	3	0	5	0	0	5
Average	8	6	2	3	5	4	4	0	7	1	1	7
Percentage	100%	75%	25%	38%	63%	50%	50%	0%	88%	13%	13%	88%

Table 5-136: Noon Bicycle Counts for Lincoln Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	16	14	2	7	9	6	10	3	13	0	7	9
2-Jul-15	10	10	0	6	4	5	5	0	10	0	5	5
Average	13	12	1	7	7	6	8	2	12	0	6	7
Percentage	100%	92%	8%	50%	50%	43%	57%	14%	86%	0%	46%	54%

Table 5-137: PM Bicycle Counts for Lincoln Avenue at 2550 South, Ogden

		Gender		*Purpose*		*Direction*			*Age*		*Use of Facility*	
	Cyclists	**Male**	**Female**	**Recreation**	**Commute**	**NB/EB**	**SB/WB**	**Youth**	**Adult**	**Senior**	**Yes**	**No**
1-Jul-15	15	15	0	7	8	11	4	4	10	1	9	6
2-Jul-15	10	8	2	6	4	2	8	0	7	3	5	5
Average	13	12	1	7	6	7	6	2	9	2	7	6
Percentage	100%	92%	8%	54%	46%	54%	46%	15%	69%	15%	54%	46%

5.7 Chapter Summary

For this research project it was necessary to collect bicycle volume data. Bicycle volume data were collected using two research methods and data were collected in five counties throughout Utah. The five counties that data was collected were Davis, Salt Lake, Utah, Washington, and Weber County. Multiple sites from each county were observed and the bicycle volumes collected during peak hours of the day. Data were collected at most of the sites for a two day time frame. The data collected in the chapter will be evaluated in Chapter 6. A summary of the sites can be found in Appendix C.

6 DATA EVALUATION

6.1 Overview

After the bicycle volume data were collected the data were analyzed to identify trends. The first step in the analysis was to convert the bicycle volumes into rates to provide a more uniform comparison. Several analyses were run including an analysis of bicycle rate compared to AADT, bicycle rate compared to posted speed limit, bicycle rate compared to number of vehicle lanes, and bicycle rate compared to roadway classification. Some of the data was transformed using a natural log transformation due to not meeting the general assumption that the data is normally distributed. Each comparison resulted in a different number of inputs resulting in some of the data being transformed for some of the comparisons. This phenomenon occurs due to the lack of data for some sites such as AADT or posted speed for some of the sites observed. A comparison of sites with bicycle infrastructure to sites without bicycle infrastructure (non-bicycle infrastructure) was conducted to identify relationships. Each of the comparisons and evaluations are provided in the following sections.

6.2 Bicycle Rate Compared to AADT

An analysis was conducted to compare the bicycle rate at each of the sites investigated where AADT data were available to their respective AADT. The bicycle rates provided in the analysis were calculated using the bicycle volume data collected as outlined in Chapter 5. The peak bicycle rates were used for the analysis and will further be referred to as bicycle rates. The peak bicycle rates for AM, Noon and PM were 7:30 AM to 8:30 AM, 11:00 AM to 12:00 PM, and 5:30 PM to 6:30 PM, respectively. The bicycle rates are the number of cyclists per hour during the peak. Bicycle rates were determined to be a better procedure for defining potential trends with AADT than that of total bicycle volumes. The 2013 AADT values recorded by UDOT were used for the analysis of bicycle rates compared to AADT as they were the most recent volumes available at the time of the study. The bicycle rates versus AADT analysis was conducted in three stages:

- The first stage was to compare the bicycle rates and AADT for all sites in Davis, Salt Lake, Utah, and Weber County. Sites in Washington County were not included in any of the bicycle rates versus AADT analysis due to a lack of AADT data for all of the sites in Washington County.
- The second stage of the AADT analysis was to compare bicycle rates and AADT for sites with bicycle infrastructure. All sites with bicycle infrastructure were included in the analysis.
- The last stage of the AADT analysis was to compare bicycle rates and AADT for sites that did not have bicycle infrastructure.

It is noted that an analysis on all three peak time periods were analyzed but only the Noon time period is presented in this chapter. Results for AM and PM peaks can be found in Appendix D and Appendix E, respectively.

6.2.1 All Sites

The first analysis was to compare the bicycle rates at each site with the respective AADT for Davis, Salt Lake, Utah, and Weber County. The bicycle volumes collected at each site were converted to bicycles per hour (bikes/hour) and were compared to the most recent AADT data for each of the representative sites. The bicycle rates and AADT for this analysis were transformed to a natural log scale to provide a better representation of the data. A natural log transformation of both the bicycle rates and the AADT was necessary due to the lack of normality and the data being positively skewed. The natural log transformation corrected the issue of positive skew and lack of a normal distribution of the data. The results of the Noon peak bicycle rates versus AADT for all sites is represented by the scatter plot and best fit line in Figure 6-1.

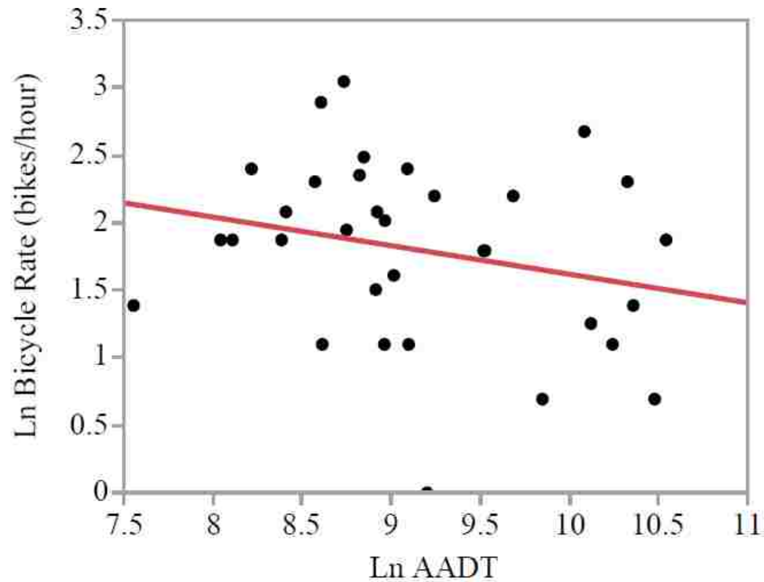

Figure 6-1: Noon bicycle rates compared to AADT for all sites.

Figure 6-1 provides evidence of a gradual decrease in the natural log of Noon bicycle rates as the natural log of AADT increases. A statistical t-test was performed to evaluate the significance of the decreasing logged bicycle rates to that of an increased logged AADT. A p-value of 0.1730 resulted for this regression model at a 95 percent confidence level. Table 6-1 provides a summary of the results of the statistical analysis.

Table 6-1: Statistical Results of Noon Bicycle Rate Compared to AADT for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	3.729477	1.389277	2.68	0.0116	0.8960278	6.5629262
Ln AADT	-0.211145	0.151388	-1.39	0.1730	-0.519902	0.0976124

The p-value for the natural log transformed Noon bicycle rates compared to the natural log transformed AADT reveals a p-value greater than the 0.05 p-value that is necessary for a 95 percent statistically significant result. A back transformation of the results reveals that as AADT doubles there will be a 14 percent reduction in bicycle rates. Thus a statistically significant relationship does not occur between the natural log transformed bicycle rates and the natural log-transformed AADT for all sites. Although there is no statistical significance for this data when comparing bicycle rates to AADT for all sites where data were collected, there is a gradual and distinct downward trend suggesting a reduction in bicycle rates as AADT increases.

6.2.2 Sites With Bicycle Infrastructure

The second analysis conducted to compare bicycle rates to AADT was to evaluate any relationship that may exist when only sites with bicycle infrastructure are evaluated. Sites with bicycle infrastructure are roadways that include any type of bicycle infrastructure as outlined in Chapter 2 and reported in Chapter 5. A natural log transformation of both the bicycle rates and the AADT was again necessary due to the data being positively skewed and lack of normality. The natural log transformation corrected the issue of positive skew and the lack of a normal distribution of the data. The results of the Noon peak bicycle rates compared to the AADT for sites with bicycle infrastructure are outlined in Figure 6-2.

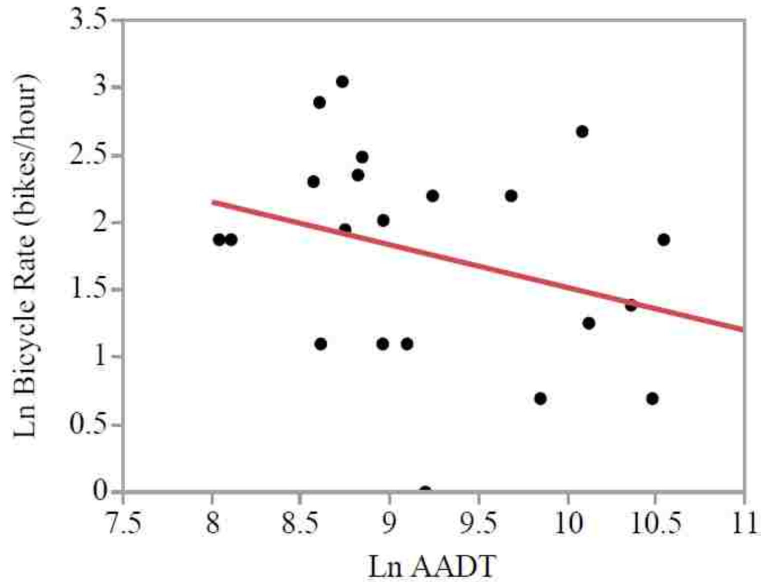

Figure 6-2: Noon bicycle rates compared to AADT for sites with bicycle infrastructure.

Figure 6-2 again reveals a distinct and gradual decrease in the natural log of Noon bicycle rates as the natural log of AADT increases. A statistical t-test was performed to evaluate the significance of the decreasing logged bicycle rates to that of an increased logged AADT. A p-value of 0.1808 resulted for this regression model at a 95 percent confidence level. Table 6-2 provides a summary of the results.

Table 6-2: Statistical Results of Noon Bicycle Rates Compared to AADT for Roadways With Bicycle Infrastructure

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	4.6865223	2.110433	2.22	0.0387	0.2963351	9.1037095
Ln AADT	-0.316901	0.228093	-1.39	0.1808	-0.794305	0.1605035

The p-value for the natural log-transformed Noon bicycle rates compared to the natural log-transformed AADT reveals a p-value greater than the 0.05 that is necessary for a 95 percent statistically significant result. A back transformation of the results reveals that as AADT doubles there will be a 20 percent reduction in bicycle rates. Thus a statistically significant relationship between the natural log transformed bicycle rate and the natural log transformed AADT does not exist for sites with bicycle infrastructure. Again, although there is no statistical significance for this data when comparing bicycle rates to AADT for sites with bicycle infrastructure, there is a gradual and distinct downward trend suggesting a reduction in bicycle rate as AADT increases.

6.2.3 Sites Without Bicycle Infrastructure

The third analysis conducted to compare bicycle rates to AADT was to evaluate any relationship that may exist when only sites without bicycle infrastructure are evaluated. Sites without bicycle infrastructure are the roadways that do not have a bicycle infrastructure of any kind and were not included in the previous analysis. A natural log transformation of AADT was again necessary due to the data being positively skewed and the lack of normality. The natural log transformation corrected the issue of positive skew and lack of a normal distribution of the data. The bicycle rates did not require any transformations. The results of the Noon peak bicycle rates compared to the AADT for roadways without bicycle infrastructure are outlined in Figure 6-3.

Figure 6-3 again reveals a distinct and gradual decrease in the Noon bicycle rates as the natural log of AADT increases. A statistical t-test was performed to evaluate the significance of the bicycle rates to the logged AADT. A p-value of 0.4400 resulted for this regression model at a 95 percent confidence level. Table 6-3 provides a summary of the results.

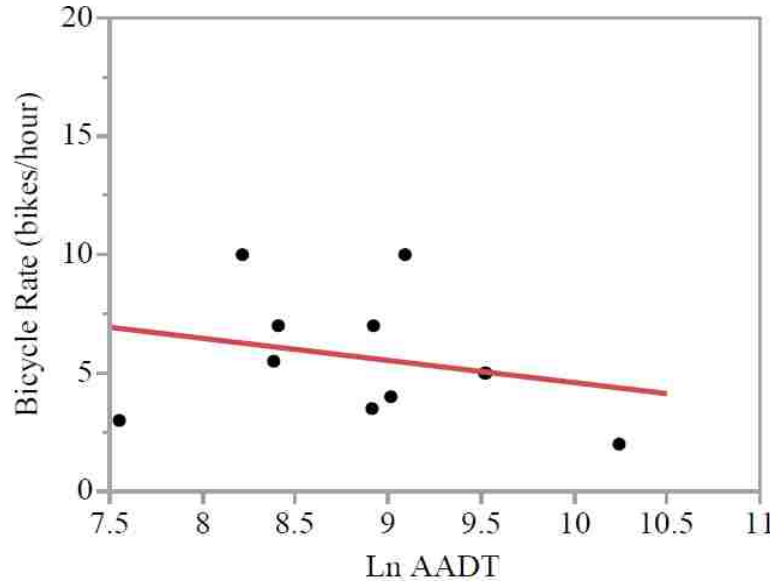

Figure 6-3: Noon bicycle rates compared to AADT for sites without bicycle infrastructure.

Table 6-3: Statistical Results of Noon Bicycle Rates Compared to AADT for Roadway Without Infrastructure

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	13.944765	10.31545	1.35	0.2094	-9.390404	37.279933
Ln AADT	-0.934616	1.156787	-0.81	0.4400	-3.551451	1.682219

The p-value for the Noon bicycle rates compared to the natural log transformed AADT reveals a p-value greater than the 0.05 that is necessary for a 95 percent statistically significant result. A back transformation of the results reveals that as AADT doubles there will be a 48 percent reduction in bicycle rates. Thus the relationship between the bicycle rates and the natural log transformed AADT does not exist for sites without bicycle infrastructure. It is determined that no statistical significance exists for this data when comparing bicycle rates to AADT for sites without bicycle infrastructure.

6.3 Bicycle Rates Compared to Posted Speed Limit

The second set of analysis that was performed on the data collected was to view the potential relationship between bicycle rates and the posted speed limit of the roadway. The bicycle rates used for this analysis were the same bicycle rates used in Section 6.2. The posted speed limits were determined while in the field. In the analysis, the Noon bicycle rates were compared to the posted speed limits. Additional analysis was conducted using the AM and PM bicycle rates and can be found in Appendix D and Appendix E, respectively. The analysis was conducted in three phases, similar to the AADT analysis. Three groups of analysis were performed in comparing the bicycle rates to the posted speed limit: all sites, only sites with bicycle infrastructure, and only sites without bicycle infrastructure for Davis, Salt Lake, Utah, and Weber County.

6.3.1 All Sites

The first analysis was to compare the bicycle rates at each site to the posted speed limit. The initial data revealed a normal distribution of the data requiring no transformations of any kind on either the bicycle rates or the posted speed limit. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The posted speed limit ranged from 20 to 45 mph. Figure 6-4 provides a simple linear regression plot of the data.

Figure 6-4 provides evidence of a gradual decrease in Noon bicycle rates as the posted speed limit increases. To better understand if the relationship between bicycle rates and posted speed limit is significant a standard t-test was conducted on the data. A p-value of 0.0471 resulted for this regression model at a 95 percent confidence level. Table 6-4 provides a summary of the results of the statistical analysis.

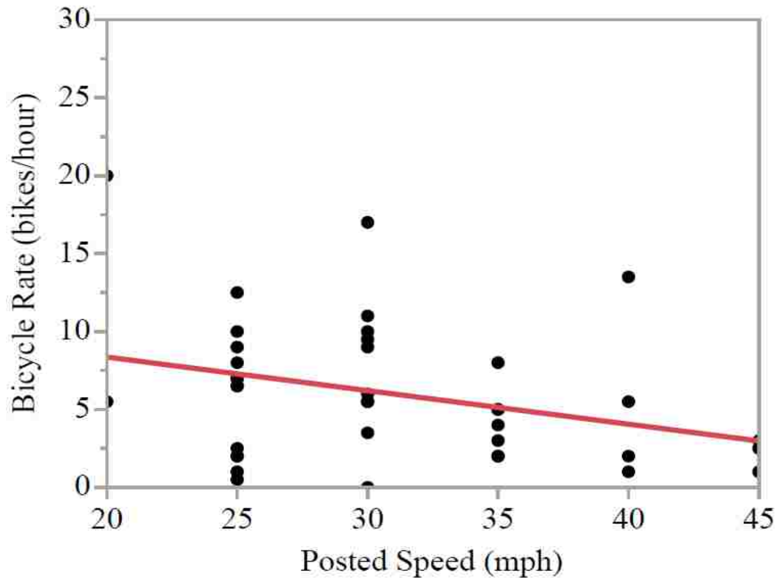

Figure 6-4: Noon bicycle rates compared to posted speed limits for all sites.

Table 6-4: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	12.665993	3.314994	3.82	0.0005	5.9491777	19.382808
Posted Speed (mph)	-0.215331	0.104863	-2.05	0.0471	-0.427803	-0.002858

The results show that the relationship between the Noon bicycle rates and the posted speed limit for all of the sites is statistically significant at a 95 percent confidence level (p-value less than 0.05). Thus a statistically significant relationship between the Noon bicycle rates and the posted speed limit exists for all sites. With the results revealing statistical significance, an equation was established relating the relationship between the bicycle rates and the posted speed limits. Equation 6-1 provides the relationship between Noon bicycle rates ($BR_{N,All}$) and the posted speed limit (S) for all sites. The R^2 value for this model is 0.10.

$$BR_{N,All} = 12.67 - 0.215331 * S \qquad (6\text{-}1)$$

6.3.2 Sites With Bicycle Infrastructure

The second analysis when comparing bicycle rates to the posted speed limit was to evaluate any relationship that may exist when only sites with bicycle infrastructure are evaluated. Sites with bicycle infrastructure are roadways that include any type of bicycle infrastructure as outlined in Chapter 2 and reported in Chapter 5. The initial data required no transformations of any kind on either the bicycle rates or the posted speed limit. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The posted speed limit ranged from 20 to 45 mph. Figure 6-5 provides a simple linear regression plot of the data.

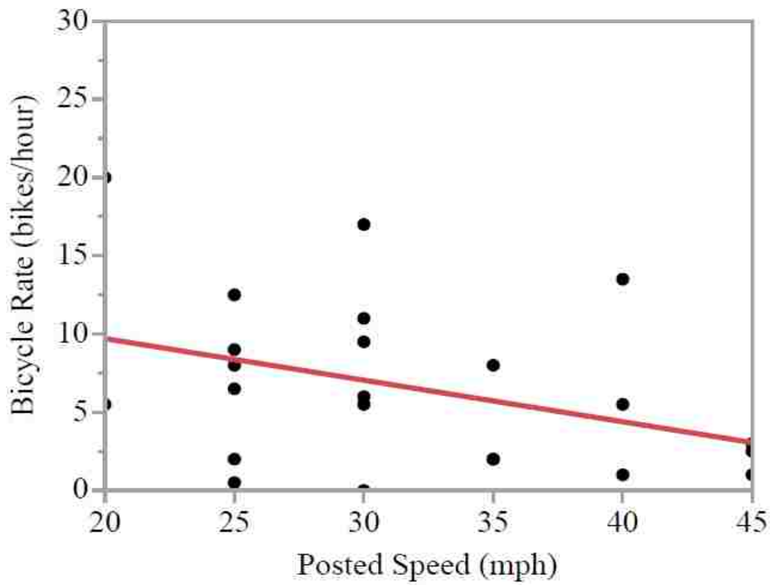

Figure 6-5: Noon bicycle rates compared to posted speed limit for sites with bicycle infrastructure.

Figure 6-5 provides evidence of a gradual decrease in Noon bicycle rates as the posted speed limit increases. To better understand if the relationship between Noon bicycle rates and posted speed limit is significant, a standard t-test was conducted on the data. A p-value of 0.0732 resulted for this regression model at a 95 percent confidence level. Table 6-5 provides a summary of the results of the statistical analysis.

Table 6-5: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for Sites with Bicycle Infrastructure

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	15.019608	4.597576	3.27	0.0037	5.4584255	24.58079
Posted Speed (mph)	-0.265686	0.140867	-1.89	0.0732	-0.558636	0.027263

The results show that the relationship between the Noon bicycle rates and the posted speed limit for sites with bicycle infrastructure is not statistically significant; however it is nearly significant at a 95 percent level of significance with a p-value of 0.0732, suggesting that the relationship is practically significant. With the results revealing a strong practical relationship between the bicycle rates and posted speed limit an equation was established. Equation 6-2 provides the relationship between Noon bicycle rates ($BR_{N,WBI}$) and the posted speed limit (S) for sites with bicycle infrastructure. The R^2 value for this model is 0.14.

$$BR_{N,WBI} = 15.019608 - 0.265686 * S \qquad (6\text{-}2)$$

6.3.3 Sites Without Bicycle Infrastructure

The third analysis when comparing bicycle rates to the posted speed limit was to evaluate any relationship that may exist when only sites without bicycle infrastructure are evaluated. Sites without bicycle infrastructure are any roadways that do not contain bicycle infrastructure as outlined in the Chapter 2 and reported in Chapter 5. The initial data required no transformations of any kind on either the bicycle rates or the posted speed limit. Bicycle rates for this analysis ranged from 1 to 10 bicycles per hour. The posted speed limit ranged from 25 to 40 mph. Figure 6-6 provides a simple linear regression plot of the data.

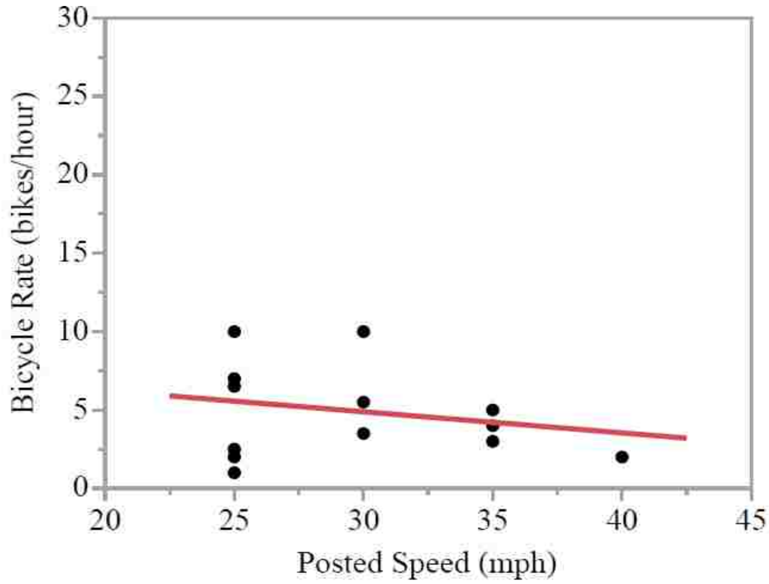

Figure 6-6: Noon bicycle rates compared to posted speed for sites without bicycle infrastructure.

Figure 6-6 provides evidence of a very gradual decrease in Noon bicycle rates as the posted speed limit increases. To better understand if the relationship between Noon bicycle rates and posted speed limit is significant, a standard t-test was conducted on the data. A p-value of 0.3674 resulted for this regression model at a 95 percent confidence level. Table 6-6 provides a summary of the results of the statistical analysis.

Table 6-6: Statistical Results of Noon Bicycle Rates Compared to Posted Speed Limit for Sites Without Bicycle Infrastructure

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	8.9330357	4.342916	2.06	0.0603	-0.449264	18.315335
Posted Speed (mph)	-0.134821	0.144363	-0.93	0.3674	-0.446700	0.1770568

The results show that the relationship between the Noon bicycle rates and the posted speed limit for sites without bicycle infrastructure is not statistically significant. Thus a relationship between the bicycle rates and the posted speed limit does not exist for sites without bicycle infrastructure. With the results revealing no statistical significance in the relationship a proper equation cannot be established.

6.4 Bicycle Rates Compared to Number of Vehicle Lanes

The third set of analysis that was performed on the bicycle data was to determine if bicycle rates showed a significant trend towards a specific number of lanes on the roadways. The bicycle rates used for this analysis were the same bicycle rates used in Section 6.2 and 6.3. The number of lanes was determined while in the field. In the analysis, the Noon bicycle rates were compared to the number of lanes on the roadway. Additional analysis was conducted using the AM and PM bicycle rates and can be found in Appendix D and Appendix E, respectively. The analysis was conducted in three phases, similar to the analysis previously outlined in the AADT and posted speed limit sections. Three groups of analysis were performed in comparing the bicycle rates to number of lanes: all data sets, only sites with bicycle infrastructure, and only sites without bicycle infrastructure for Davis, Salt Lake, Utah, and Weber County.

6.4.1 All Sites

The first analysis was to compare the bicycle rates to the number of lanes. The initial data required no transformations of any kind on either the bicycle rates or the number of lanes. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The number of lanes ranged from 2 to 6 lanes. Figure 6-7 provides a box plot of the data.

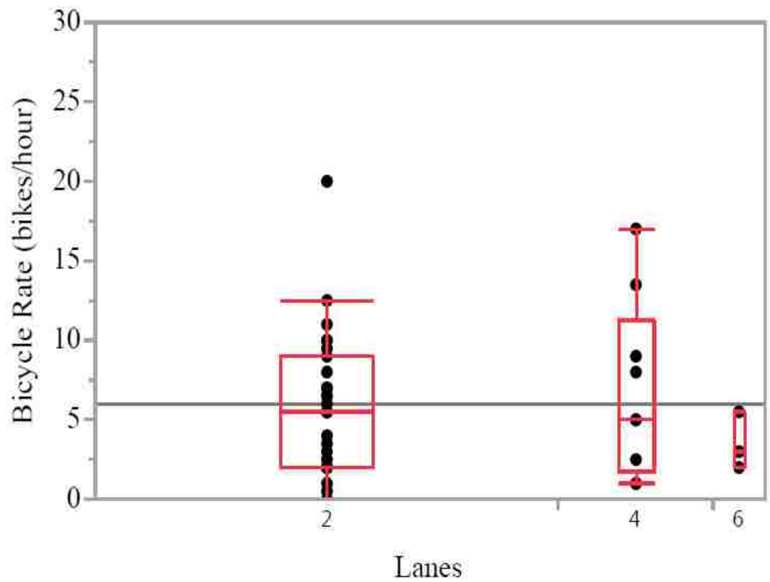

Figure 6-7: Noon bicycle rates compared to number of lanes for all sites.

Table 6-7: Statistical Results of Noon Bicycle Rates Compared to Number of Lanes for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Lanes	2	25.85470	12.9274	0.6088	0.5495
Error	36	764.38889	21.2330		
Total	38	790.24359			

The results show that the relationship between the Noon bicycle rates and the number of lanes for all sites is not statistically significant. With the results revealing no statistical significance the evaluation suggests that no specific lane configuration will result in higher average bicycle rates than another for all sites.

6.4.2 Sites With Bicycle Infrastructure

The second analysis conducted was to determine if a particular number of lanes would result in a higher bicycle rate when only sites with bicycle infrastructure are evaluated. The initial data required no transformations of any kind on either the bicycle rates or the number of lanes. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The number of lanes ranged from 2 to 6 lanes. Figure 6-8 provides a box plot of the data.

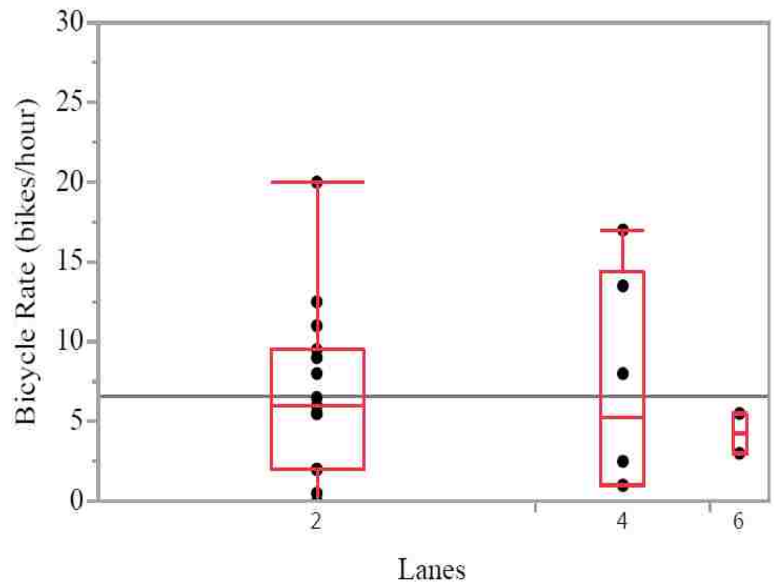

Figure 6-8: Noon bicycle rates compared to number of lanes for sites with bicycle infrastructure.

Figure 6-8 shows no apparent difference between the Noon bicycle rates and the number of lanes. To better understand if a relationship between Noon bicycle rates and number of lanes is significant an ANOVA was conducted on the data. A p-value (Prob>F) of 0.8162 resulted for this analysis at a 95 percent confidence level. Table 6-8 provides the results of the analysis.

Table 6-8: Statistical Results of Noon Bicycle Rates compared to Number of Lanes for Sites with Bicycle Infrastructure

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Lanes	2	13.03442	6.5172	0.2052	0.8162
Error	20	635.29167	31.7646		
Total	22	648.32609			

The results show that the relationship between the Noon bicycle rates and the number of lanes for all sites with bicycle infrastructures is not statistically significant. With the results revealing no statistical significance the evaluation suggests that no specific lane configuration will result in higher average bicycle rates than another for sites with bicycle infrastructure.

6.4.3 Sites Without Bicycle Infrastructure

The third analysis conducted was to determine if a particular number of lanes would result in a higher bicycle rate when only sites without bicycle infrastructure are evaluated. The initial data required no transformations of any kind on either the bicycle rates or the number of lanes. Bicycle rates for this analysis ranged from 1 to 10 bicycles per hour. The number of lanes ranged from 2 to 6 lanes. Figure 6-9 provides a box plot of the data.

Figure 6-9 shows no apparent difference between the Noon bicycle rates and the number of lanes. To better understand if a relationship between Noon bicycle rates and number of lanes is significant an ANOVA was conducted on the data. A p-value (Prob>F) of 0.4544 resulted for the analysis at a 95 percent confidence level. Table 6-9 provides the results of the analysis.

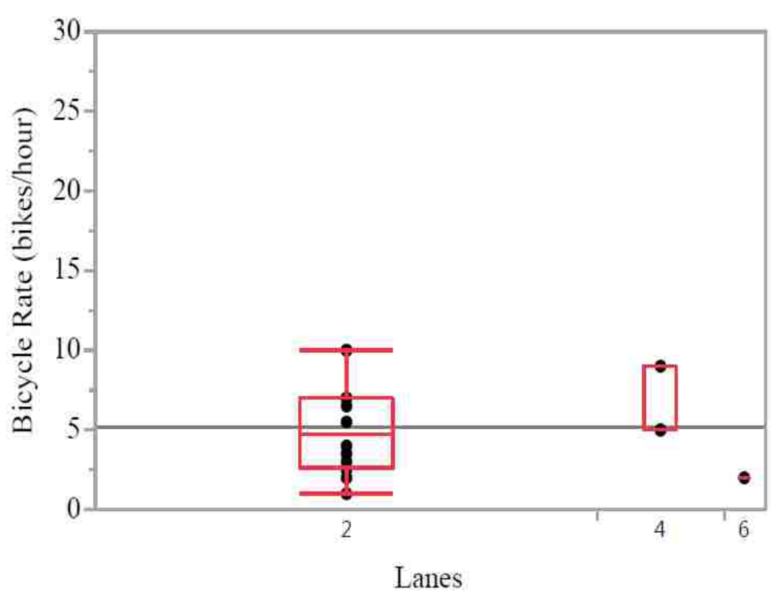

Figure 6-9: Noon bicycle rates compared to number of lanes for sites without bicycle infrastructure.

Table 6-9: Statistical Results of Noon Bicycle Rates Compared to Number of Lanes for Sites Without Bicycle Infrastructure

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Lanes	2	14.10417	7.05208	0.8385	0.4544
Error	13	109.33333	8.41026		
Total	15	123.43750			

The results show that the relationship between the Noon bicycle rates and the number of lanes for sites without bicycle infrastructure is not statistically significant. With the results revealing no statistical significance the evaluation suggests that no specific lane configuration will result in higher average bicycle rates than another for sites without bicycle infrastructure.

6.5 Bicycle Rates Compared to Roadway Classification

The fourth and final analysis that was performed on the bicycle data was to determine if bicycle rates showed a significant trend towards a specific classification of roadway. The road classification for each site were classified by UDOT. In the analysis, the Noon bicycle rates were grouped in each of the four road classifications that were present at the study sites. Additional analysis was conducted using the AM and PM bicycle rates and can be found in Appendix D and Appendix E, respectively. The analysis was conducted in three phases, similar to the analysis previously outlined in the number of lanes analysis. Three groups of analysis were performed in comparing the bicycle rates to roadway classification: all sites, only sites with bicycle infrastructure, and only sites without bicycle infrastructure for Davis, Salt Lake, Utah, and Weber County.

6.5.1 All Sites

The first analysis was to compare bicycle rates to the classification of the roadway using all of the data sets where a roadway classification was determined. Sites with bicycle infrastructure, such as shared use paths, were not included in this analysis. The initial data required no transformations of any kind on either the bicycle rates or the roadway classification. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The four roadway classifications used for this analysis were Local roads, Major Collectors, Minor Arterials, and Other Principal Arterials. Figure 6-10 provides a box plot of the bicycle rates grouped in the four roadway classifications.

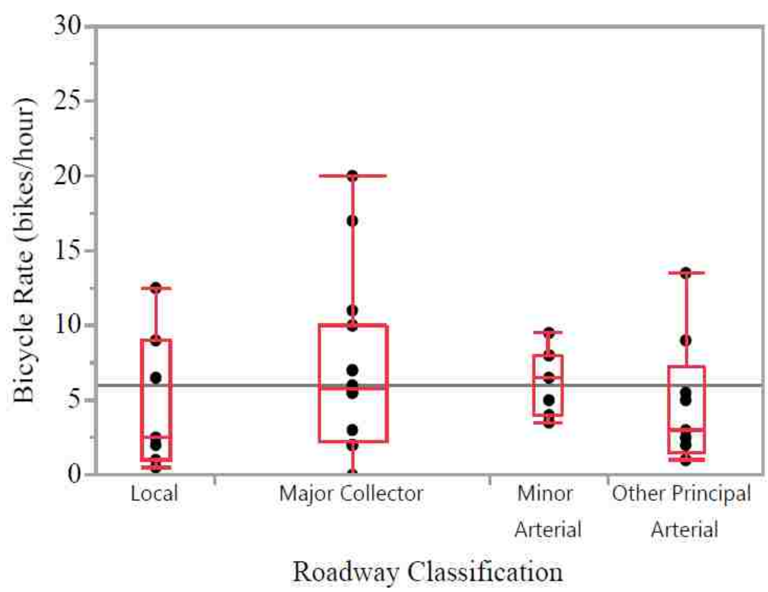

Figure 6-10: Noon bicycle rates compared to roadway classifications for all sites.

Figure 6-10 shows no apparent difference between the Noon bicycle rates and the roadway classification. To better understand if a relationship exists between the Noon bicycle rates and the four roadway classifications an ANOVA was conducted on the data. A p-value

(Prob>F) of 0.5669 resulted for the analysis at a 95 percent confidence level. Table 6-10 provides the results of the analysis.

Table 6-10: Statistical Results of Noon Bicycle Rates Compared to Roadway Classification for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	43.86437	14.6215	0.6856	0.5669
Error	35	746.37922	21.3251		
Total	38	790.24359			

The results show that the relationship between the Noon bicycle rates and roadway classification for all sites is not statistically significant. With the results revealing no statistical significance the evaluation suggests that no specific roadway classification will result in higher average bicycle rates than another for all sites.

6.5.2 Sites With Bicycle Infrastructure

The second analysis was to compare bicycle rates to the classification of the roadway using data from only sites with bicycle infrastructure and roadway classification. The initial data required no transformations of any kind on either the bicycle rates or the roadway classification. Bicycle rates for this analysis ranged from 0 to 20 bicycles per hour. The four roadway classifications used for this analysis were Local roads, Major Collectors, Minor Arterials, and Other Principal Arterials. Figure 6-11 provides a box plot of the bicycle rates grouped in the four roadway classifications.

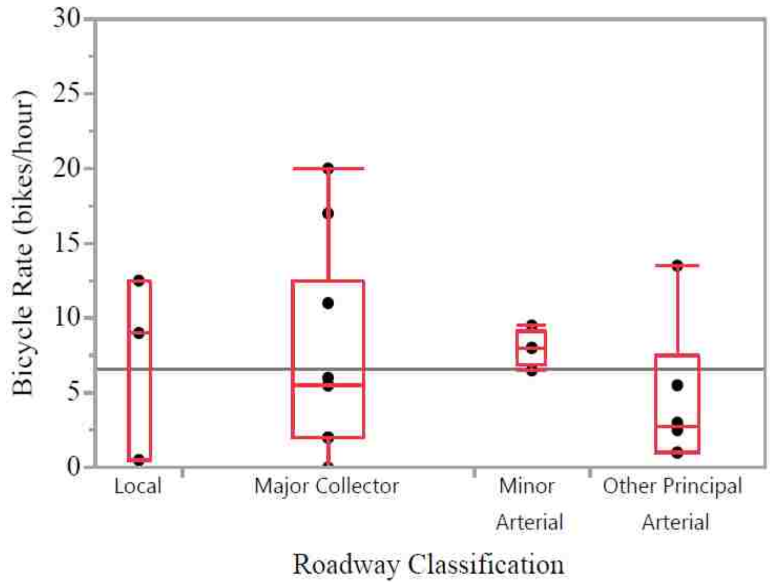

Figure 6-11: Noon bicycle rates compared to roadway classification for sites with bicycle infrastructure.

Figure 6-11 shows no apparent difference between the Noon bicycle rates and the roadway classification. To better understand if a relationship exists between the Noon bicycle rates and the four roadway classifications an ANOVA was conducted on the data. A p-value (Prob>F) of 0.7390 resulted for the analysis at a 95 percent confidence level. Table 6-11 provides the results of the analysis.

Table 6-11: Statistical Results of Noon Bicycle Rates Compared to Roadway Classification for Sites With Bicycle Infrastructure

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	40.55109	13.5170	0.4226	0.7390
Error	19	607.77500	31.9882		
Total	22	648.32609			

The results show that the relationship between the Noon bicycle rates and roadway classification for sites with bicycle infrastructure is not statistically significant. With the results revealing no statistical significance the evaluation suggests that no specific roadway classification will result in higher average bicycle rates than another for sites with bicycle infrastructure.

6.5.3 Sites Without Bicycle Infrastructure

The third analysis was to compare bicycle rates to the classification of the roadway using data from only sites without bicycle infrastructure. The initial data required no transformations of any kind on either the bicycle rates or the road classifications. Bicycle rates for this analysis ranged from 0 to 10 bicycles per hour. The four roadway classifications used for this analysis were Local roads, Major Collectors, Minor Arterials, and Other Principal Arterials. Figure 6-12 provides a box plot of the bicycle rates grouped in the four roadway classifications.

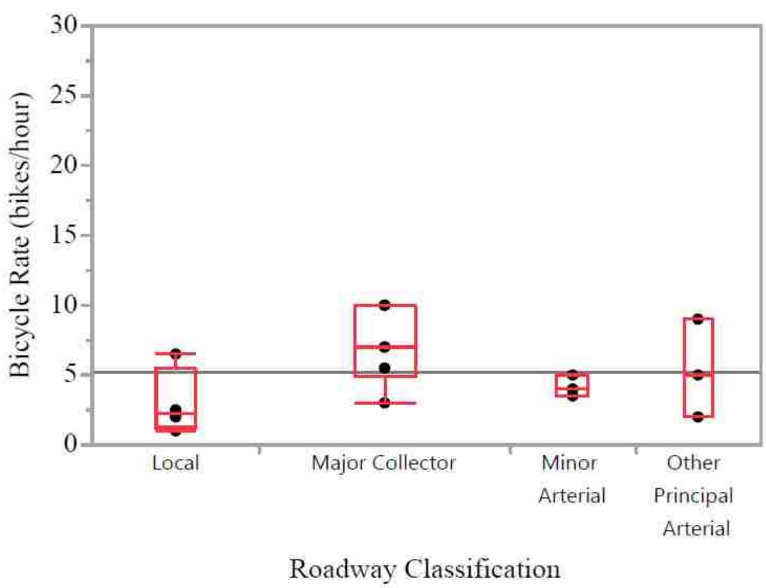

Figure 6-12: Noon bicycle rates compared to road classification for non-bicycle infrastructure roads.

Figure 6-12 shows that the Major Collector roadway classification seems to have a higher mean than the other roadways. To better understand if a relationship exists between the Noon bicycle rates and the four roadway classifications an ANOVA was conducted on the data. A p-value (Prob>F) of 0.1400 resulted for the analysis at a 95 percent confidence level. Table 6-12 provides the results of the analysis.

Table 6-12: Statistical Results of Noon Bicycle Rates Compared to Road Classification for Sites Without Bicycle Infrastructure

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	43.89583	14.6319	2.2074	0.1400
Error	12	79.54167	6.6285		
Total	15	123.4375			

The results show that the relationship between the Noon bicycle rates and roadway classification for sites without bicycle infrastructure is not statistically significant. However, the results are more significant than any other analysis related to roadway classification. The results in Figure 6-12 would indicate that Major Collectors appear to have the highest mean bicycle volume for the sample analyzed. With the results revealing no statistical significance the evaluation again suggests that no specific roadway classification will result in a statistically significant higher average bicycle rates than another for sites without bicycle infrastructure, but Major Collectors tend to have the highest mean volume for the sample analyzed.

6.6 Bicycle Infrastructure versus Non-Bicycle Infrastructure

A general comparison was conducted on the collected data to determine if sites with bicycle infrastructure would result in higher bicycle rates than the parallel roads that did not have bicycle infrastructure. This analysis was conducted in two phases: inclusion of Washington County data and exclusion of Washington County data.

6.6.1 Inclusion of Washington County

The first analysis of sites with bicycle infrastructure versus sites without bicycle infrastructure included data from Davis, Salt Lake, Utah, Washington, and Weber County. A mixed model ANOVA analysis was completed on the data collected to identify correlation and relationships between volume, infrastructure, AADT, and speed limit. The mixed model analysis showed a 66 percent increase in volume of cyclists on roadways with bicycle infrastructure when compared to roadways without bicycle infrastructure when the results were back transformed with a p-value of 0.0862. Table 6-13 provides the results of the least square means and Table 6-14 provides the results of the analysis. The numerator degrees of freedom (Num DF) and the denominator degrees of freedom (Den DF) are represented in Table 6-14.

Table 6-13: Results of the Least Square Means

Effect	Bike Lane	Estimate	Standard Error	DF	t Value	Pr > |t|
Bike Lane	No	3.1762	0.2934	5	10.82	0.0001
Bike Lane	Yes	3.6867	0.2722	5	13.54	<0.0001

Table 6-14: Results of the Mixed Model ANOVA

Effect	Num DF	Den DF	F Value	Pr > F
Posted Speed	5	26	1.27	0.3067
Lanes	2	26	1.34	0.2803
Bike Lane	1	5	4.55	0.0862

In addition, a comparison of the maximum, minimum, average, and standard deviations of sites with and without bicycle infrastructure was established. Table 6-15 provides the results of roadways with bicycle infrastructure and roadways without bicycle infrastructure.

Upon review of the results, roadways that have bicycle infrastructure have a higher maximum and a higher average bicycle rate than the roadways without bicycle infrastructure.

Table 6-15: Sites With Bicycle Infrastructure Versus Sites Without Bicycle Infrastructure Including all Counties

	Max (bikes/hour)	Min (bikes/hour)	Average (bikes/hour)	Standard Deviation (bikes/hour)
With Bicycle Infrastructure	20	0	7	5
Without Bicycle Infrastructure	10	10	5	3

6.6.2 Exclusion of Washington County

The second analysis of sites with bicycle infrastructure versus sites without bicycle infrastructure including data from Davis, Salt Lake, Utah, and Weber County. Washington County was excluded from this analysis as the results of the Washington County data were perceived to be very different from other locations. A mixed model ANOVA analysis was completed on the data collected to identify correlation and relationships between volume, infrastructure, AADT, and speed limit. The mixed model analysis showed a 40 percent increase in volume of cyclists on roadways with bicycle infrastructure with a p-value of 0.2061 when the results were back transformed. Table 6-16 provides the results of the least square means and Table 6-17 provides the results of the analysis. The numerator degrees of freedom (Num DF) and the denominator degrees of freedom (Den DF) are represented in Table 6-17.

Table 6-16: Results of the Least Square Means

Effect	Bike Lane	Estimate	Standard Error	DF	t Value	Pr > |t|
Bike Lane	No	3.4057	0.2131	3	15.99	0.0005
Bike Lane	Yes	3.7394	0.1899	3	19.69	0.0003

Table 6-17: Results of the Mixed Model ANOVA

Effect	Num DF	Den DF	F Value	Pr > F
Posted Speed	5	22	2.22	0.0889
Lanes	2	22	1.99	0.1610
Bike Lane	1	3	2.59	0.2061

In addition, a comparison of the maximum, minimum, average, and standard deviations of sites with and without bicycle infrastructure was established. Table 6-18 provides the results of roadways with bicycle infrastructure and roadways without bicycle infrastructure.

Table 6-18: Sites With Bicycle Infrastructure Versus Sites Without Bicycle Infrastructure Excluding Washington County

	Max (bikes/hour)	Min (bikes/hour)	Average (bikes/hour)	Standard Deviation (bikes/hour)
With Bicycle Infrastructure	20	1	8	5
Without Bicycle Infrastructure	10	2	6	3

Upon review of the results roadways that have bicycle infrastructure have a higher maximum and a higher average bicycle rate than the roadways without bicycle infrastructure.

6.7 Additional Trends

Along with the trends and comparisons that have been provided, it was necessary to determine if bicycle rate has increased or decreased over the years. Little to no long term data are available for bicycle volumes on roadways but some data does exist on shared use paths. Bicycle volumes on shared use paths were reviewed to determine if bicycle rates have increased. Three shared use paths were reviewed: College Connector Trail, Provo River Trail, and Murdock Canal Trail. All three shared use paths are located in Utah County and bicycle data for all three locations was provided by the Mountainland Associations of Governments (MAG).

6.7.1 College Connector Trail

The first shared use path reviewed was the College Connector Trail. The College Connector Trail runs along University Parkway between Orem and Provo. Data were only available from August 2013 to October 2014. Data collection malfunctions had occurred which resulted in limited data available for this site. August through October for each year was examined as a comparison. Total number of cyclists recorded for August, September and October for both years were plotted as shown in Figure 6-13.

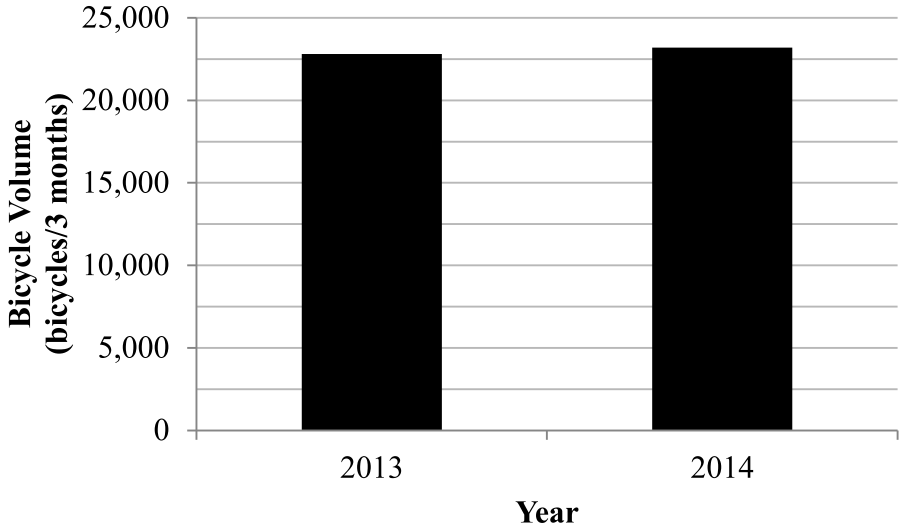

Figure 6-13: College Connector Trail volumes.

Figure 6-13 shows that there was a 1.7 percent increase in bicycle volume for the three months for each year for the College Connector Trail from 2013 to 2014.

6.7.2 Provo River Trail

The second shared use path reviewed was the Provo River Trail. The Provo River Trail begins in Orem and ends in the southern areas of Provo. The path follows the Provo River and runs along the middle of Provo City. Complete data were available for two years (2013 and 2014). Total volume of cyclists recorded for the two years were plotted as shown in Figure 6-14.

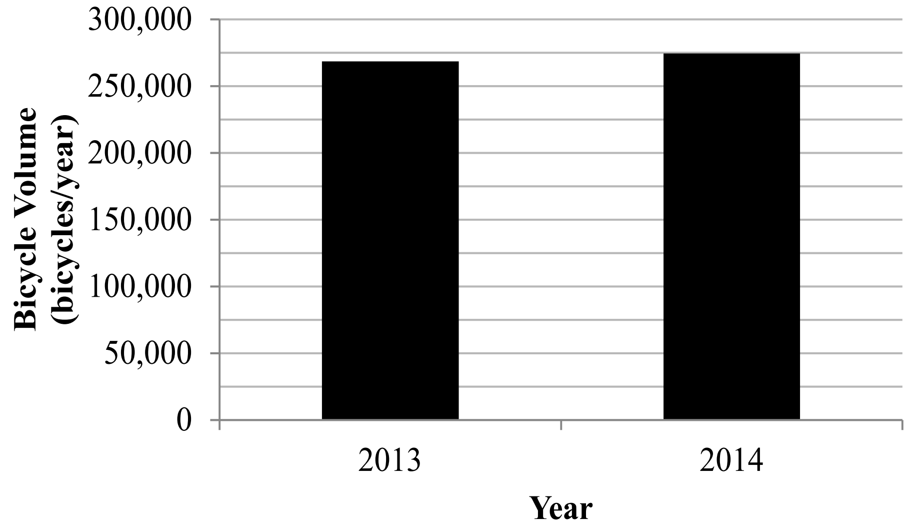

Figure 6-14: Provo River Trail volumes.

Figure 6-14 shows that there was a slight increase of 5.8 percent in bicycle volumes from 2013 to 2014 for the Provo River Trail.

6.7.3 Murdock Canal Trail

The third shared use path reviewed was the Murdock Canal Trail. The Murdock Canal Trail travels from Orem to Highland. Data were available from June 2013 to December 2014 which was a result of the Murdock Canal Trail opening during the summer of 2013. June through December for each year was examined as a comparison. Total volume of cyclists recorded from June through December for both years were plotted as shown in Figure 6-15.

Figure 6-15 shows that there was an increase of 7.5 percent in bicycle volumes from 2013 to 2014 for the Murdock Canal Trail in the seven month ranges.

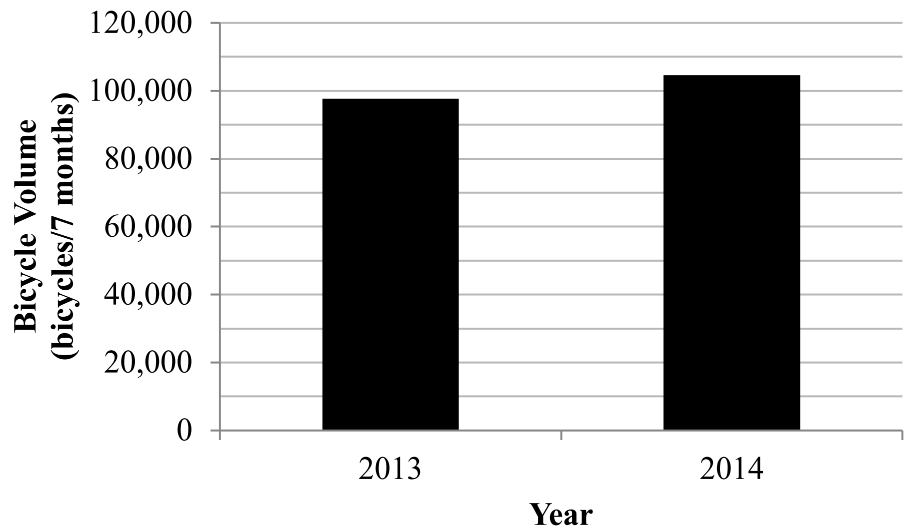

Figure 6-15: Murdock Canal Trail volumes.

6.8 Chapter Summary

Multiple comparisons and analysis were conducted on the data collected. Comparison of bicycle rates to AADT resulted in no correlation or relationship in the data but is suggestive of significance. Statistically significant results did occur when comparing bicycle rates to posted speed limits. No relationships occurred when comparing bicycle rates to the number of lanes or roadway classification with the exception of a trend toward more bicyclists on Major Collectors versus other roadway classifications. Although it was expected that AADT, posted speed limit and number of lanes would correlate in the results it is noted that each analysis had different inputs that would affect the overall results. It was determined that roadways with bicycle infrastructure tend to yield higher bicycle rates than roadways that do not have bicycle infrastructure. Lastly, using shared use path data it is determined that bicycle rate on shared use path has increased between 1.7 to 7.5 percent from 2013 to 2014 and it is assumed that a similar trend would exist on bicycle infrastructure in the communities.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary

Bicycling as an alternate mode of transportation has been on the rise. It is environmentally friendly in nature and the associated health benefits have made it a popular choice for many types of trips. With vehicle trips being replaced by bicycle trips, planning for transportation should incorporate safe access for bicycle corridors while minimizing the impact on vehicle access. With the implementation of the UDOT *Inclusion of Active Transportation* policy, information on type and level of impact has become more important. The purpose of this research was to increase understanding of the travel demand impacts of implementing bicycle corridors (as part of the UDOT *Inclusion of Active Transportation* policy) as compared to adding vehicle lanes. The results of this research will be used in determining when and where bicycle corridors may enhance the transportation system and to estimate of the impact of bicycle corridors on travel demand in Utah.

The primary objective for this research was to increase understanding of the travel demand impacts of implementing bicycle corridors as compared to adding vehicle lanes. Five secondary objectives were addressed to achieve the primary objective: 1) evaluating the impact of the UDOT *Inclusion of Active Transportation* policy in the state, 2) estimating the impact of bicycle corridors on both bicycle and vehicle mode split, 3) evaluating the impact of bicycle corridors in addition to vehicle lanes, 4) providing guidelines to be used when evaluating locations for possible bicycle corridors, and 5) providing empirical evidence on the impact of bicycle corridors across the nation.

The first objective was addressed through the efforts of the survey distributed to UDOT employees. It was determined that most employees are familiar with the policy, but the *Inclusion of Active Transportation* policy has been limited in its application due to a perceived lack of funding to cover the needs of active transportation. Thus the policy has begun encouraging the implementation of bicycle movements throughout the state but to date the policy has not met its full potential.

The second and third objectives of this research have been addressed based on the limited data available for the study. To more fully understand the impacts of bicycle corridors it will be necessary in future research efforts to collect data over a longer time span to provide estimates of the effects of implementation of bicycle corridors. To first address these objectives, data from the most recent household survey conducted by WFRC was summarized. This data showed that Utah residents do not perceive a lack of infrastructure as a reason to not ride a bicycle. Most residents simply do not own a bicycle. In addition, Utah residents are generally in favor of, or neutral toward, active transportation, a trend that has been further reinforced by recent planning studies in the state. Based on the data that were collected for this research, it was found that adding bicycle infrastructure tends to increase bicycle volume by 40 to 66 percent. The overall volume; however, is relatively low with an average of 7 bikes/hour and a maximum of 20 bikes/hour on the roadways surveyed with bicycle infrastructure. Local trends do, however, show that bicycle volume is increasing on shared use path, which is anticipated to carry over to roadways.

The fourth objective was addressed through the primary analysis that was conducted for this research. As illustrated in the next section, roadways with lower speeds and AADT should be considered for bicycle infrastructure before roadways with higher speeds and AADT as results showed that as AADT doubles bicycle volumes decrease by 18 percent.

The fifth objective to this research was limited due to a lack of bicycle data throughout the state and the nation. Little to no research has been conducted on the impacts of bicycle corridors on travel demands and thus no solid results can be presented. The results presented in this thesis will set the baseline to expand this research.

The remainder of this chapter provides the findings of the analysis conducted, limitation and challenges faced, recommendations, and an implementation plan.

7.2 Findings

To meet the objectives of the study, data on bicycle use had to be collected. Two data collection methods were used in collecting bicycle movement data at several locations across the state: automatic bicycle counting and manual bicycle counting. The automatic bicycle counting method involved tube counters specifically designed for bicycle counting. The manual bicycle counting method involved recording bicycle volumes during three peak periods (AM, Noon, and PM) for one to two consecutive days at each location.

Six analyses were conducted for this research. Five of the analyses were conducted on data collected and one comparison was made using data provided by MAG. The findings of each of the analyses are summarized in the following subsections: 1) bicycle rates compared to AADT, 2) bicycle rates compared to posted speed limit, 3) bicycle rates compared to number of lanes, 4) bicycle rates compared to roadway classification, 5) bicycle rates at sites with bicycle infrastructure versus sites without bicycle infrastructure, and 6) additional trends.

7.2.1 Bicycle Rates Compared to AADT

Three separate analyses were conducted to determine if a relationship existed between bicycle rates and AADT, and if so, whether those relationships were statistically significant. When including data from Davis, Salt Lake, Utah, and Weber County the evaluation provided evidence of a gradual decrease in bicycle volume as AADT increased, but the statistical analysis showed a p-value of 0.1730 during the Noon peak, thus, no statistical significance exists between bicycle rates and AADT but the data are suggestive of a decrease in bicycle rates as AADT increases for all sites.

Evaluating only sites with bicycle infrastructure the evaluation again showed a distinct and gradual trend in the reduction of bicycle volume as AADT increased, but the statistical analysis showed a p-value of 0.1808 during the Noon peak, thus, no statistical significance exists between bicycle rates and AADT but it is again suggestive of a decrease in bicycle rates as AADT increases for sites with bicycle infrastructure.

Evaluating only sites without bicycle infrastructure the statistical analysis resulted in a p-value of 0.4400 during the Noon peak, thus, no statistical significance of a relationship between bicycle rates and AADT exists for sites without bicycle infrastructure.

For all three evaluations the results showed no statistical significance in a relationship between bicycle rates and AADT but each of the analyses did suggest that a decrease in bicycle rates would occur as AADT increased, especially for all sites and sites with bicycle infrastructure. The results reveal that the lower AADT roadways will experience a higher bicycle rate and is suggestive that bicycle infrastructure tend to perform more efficiently on lower AADT roads.

7.2.2 Bicycle Rates Compared to Posted Speed Limit Findings

Three separate analyses were also conducted to determine if a relationship existed between bicycle rates and posted speed limit, and if so, whether those relationships were statistically significant. When including Davis, Salt Lake, Utah, and Weber County the statistical analysis showed a p-value of 0.0471 during the Noon peak, thus a statistically significant relationship exists between bicycle rates and posted speed limit at a 95 percent confidence level for all sites in this study. The results reveal that as the posted speed limit increases the bicycle rates decrease significantly for the combination of all sites with and without bicycle infrastructure.

Evaluating only sites with bicycle infrastructure the evaluation provided evidence of a decrease in bicycle volume as speed limit increased. The statistical analysis showed a p-value of 0.0732 during the Noon peak, thus, no statistical significance between bicycle rates and posted speed limit exists at a 95 percent confidence level, but there is a strong relationship that is significant at a 90 percent confidence level. Thus it is concluded that a relationship may exist between bicycle rates and posted speed limit for the roadways that have bicycle infrastructure and further investigation should be conducted with more data.

Evaluating only sites without bicycle infrastructure the statistical analysis resulted in a p-value of 0.3674 during the Noon peak, thus no statistical significance exists between bicycle rates and posted speed limit for sites without bicycle infrastructure. It is concluded that no relationship occurs between bicycle rates and posted speed limit for the roadway without bicycle infrastructure.

The results reveal that as the posted speed limit increases the bicycle rates decrease significantly for the combination of all sites with and without bicycle infrastructure.

7.2.3 Bicycle Rates Compared to Number of Lanes Findings

Three separate analyses were conducted next to determine if a relationship existed between bicycle rates and number of lanes at the site, and if so, whether those relationships were statistically significant. When including Davis, Salt Lake, Utah, and Weber County the statistical analysis showed a p-value of 0.5495 during the Noon peak, thus no statistical significance between bicycle rates and number of lanes appears to exist and it is concluded that no relationship occurs between bicycle rates and number of lanes for all sites in this study.

Evaluating only sites with bicycle infrastructure the statistical analysis resulted in a p-value of 0.8162 during the Noon peak, thus no statistical significance between bicycle rates and number of lanes and it is concluded that no relationship exists between bicycle rates and number of lanes for the roads that have bicycle infrastructure.

Evaluating only sites without bicycle infrastructure the statistical analyses showed a p-value of 0.4544 during the Noon peak, thus no statistical significance between bicycle rates and number of lanes appear to exist and it is again concluded that no relationship exists between bicycle rates and number of lanes for roadways without bicycle infrastructure.

For all three evaluations the results showed no statistical significance in a relationship between bicycle rates and number of lanes. No specific lane configuration showed a higher bicycle rate than the others.

7.2.4 Bicycle Rates Compared to Roadway Classification

Three separate analyses were conducted to determine if a relationship existed between bicycle rates and roadway classification, and if so, whether those relationships were statistically significant. When including Davis, Salt Lake, Utah, and Weber County the statistical analysis showed a p-value of 0.5669 during the Noon peak, thus no statistical significance between bicycle rates and roadway classification appears to exist and it is concluded that no relationship occurs between bicycle rates and roadway classification for all sites in this study.

Evaluating only sites with bicycle infrastructure the study showed a p-value of 0.7390 during the Noon peak. Again, no statistical significance exists between bicycle rates and roadway classification appears to exist and it is concluded that no relationship exists between bicycle rates and roadway classification for the sites with bicycle infrastructure.

Evaluating only sites without bicycle infrastructure the study resulted in a p-value of 0.1400 during the Noon peak, thus no statistical significance of a relationship between bicycle rates and roadway classification exists but the analysis does reveal that a difference between one of the roadway classification and the others is possible. The graphical representation of the results would indicate that Major Collectors appear to have the highest bicycle volume of all roadway classifications included in the analysis. It is concluded that no relationship occurs between bicycle rates and roadway classification for all sites in this study.

For the first two evaluations the results showed no statistical significance in a relationship between bicycle rates and roadway classification. However, the third analysis did suggest a slightly higher mean rate between the Major Collector classification and the other classifications.

7.2.5 Bicycle Infrastructure versus Non-Bicycle Infrastructure

A general comparison was made to determine if roadways with bicycle infrastructure resulted in higher bicycle rates than adjacent roadways without bicycle infrastructure. The general comparisons where conducted using a mixed model analysis and a general comparison of maximum, minimum, and average bicycle rates for scenarios including and excluding Washington County data.

The first mixed model analysis using a dataset that included the Washington County data showed a 66 percent increase in bicycle ridership on roadways with bicycle infrastructure when compared to roadways without bicycle infrastructure with a p-value of 0.0862. This indicates that the presence of bicycle infrastructure will increase bicycle ridership.

The second mixed model analysis was performed using a dataset that excluded the Washington County data. The analysis showed a 40 percent increase in bicycle ridership on roadways with bicycle infrastructure when compared to roadways without bicycle infrastructure with a p-value of 0.2061. This indicates that even without the Washington County data the presence of a bicycle infrastructure will increase the bicycle ridership, but not at a statistically significant level.

The first general comparison of maximum, minimum, and average bicycle rates was performed using a dataset that included the Washington County data. The results showed that roadways with bicycle infrastructure will have a higher maximum (20 bikes/hour) and a higher average (7 bikes/hour) than roadways without bicycle infrastructure (10 and 5 bikes/hour, respectively). The results indicate that the presence of bicycle infrastructure will generate a higher maximum and average bicycle rate than the absence of bicycle infrastructure.

The second general comparison of maximum, minimum and average bicycle rates was performed using a dataset that excluded the Washington County data. The results showed that roadways with bicycle infrastructure will have a higher maximum (20 bikes/hour) and a higher average (8 bikes/hour) than roadways without bicycle infrastructure (10 and 6 bikes/hour, respectively). The results indicate that the presence of bicycle infrastructure will generate a higher maximum and average bicycle rate than the absence of bicycle infrastructure.

7.2.6 Additional Trends

To gain a more historical perspective on bicycle data, three shared use paths in Utah County were reviewed to determine if bicycle rate has increased over the years: the College Connector Trail, Provo River Trail, and Murdock Canal Trail.

The College Connector Trail had two years of data available. The first year (2013) for three months showed a total bicycle volume of 22,815 bicycles. The second year (2014) for three months showed a total bicycle volume of 23,195 bicycles. The data showed an increase of 1.7 percent in bicycle rate between the two years.

The Provo River Trail also had two years of data available. The first year (2013) showed a total bicycle volume of 260,000 bicycles per year. The second year (2014) showed a total bicycle volume of 275,000 bicycles per year. The data reveals an increase of 5.8 percent in bicycle rate between the two years.

The third shared use path reviewed was the Murdock Canal Trail and again had two years of data available. The first year (2013) for seven months showed a total bicycle volume of 97,667 bicycles. The second year (2014) for seven months showed a total bicycle volume of 104,950 bicycles. The data reveals an increase of 7.5 percent in bicycle rate between the two years.

All three of the shared use paths reviewed showed an increase in bicycle rate from 2013 to 2014 ranging from 1.7 to 7.5 percent. This indicates that more people are using the shared use paths and it is assumed that a similar trend exists for bicycle infrastructure on roadways.

7.3 Limitations and Challenges

Upon the original proposal of this project it was assumed that bicycle volume data would be available to evaluate and additional data could be collected for comparison. As the project moved forward it became clear that appropriate bicycle volume data were not available for this research and that this research would form a baseline for future research on impacts of bicycle corridors. Data at 42 sites were observed throughout the state, and although this is a small representation of the total number of sites that could be evaluated it was determined to be sufficient for the objectives of the research.

7.4 Recommendations

This project has established a general baseline for future research on bicycle corridors and provides recommendations to UDOT on the subject of bicycle corridors in Utah. The results of the baseline indicate that in general the overall bicycle volume on the roadway evaluated are relatively low (maximum of 20 bikes/hour); however, results at permanent bicycle count stations on shared use paths show that bicycle use is gradually increasing. Based on these trends, three recommendations are provided:

1. UDOT should continue to emphasize and implement the *Inclusion of Active Transportation* policy in the state to help provide alternatives and improve the multimodal nature of the state. As part of this recommendation UDOT should work to educate employees on the policy and its benefits in an increasingly active society. In addition, active transportation needs must be considered early in the planning stages of a project.
2. UDOT should focus preliminary installation of bicycle infrastructure on lower speed roadways as these tend to have the highest bicycle volume and are therefore assumed to provide the best results. The focus can then expand or shift as more facilities are provided and evaluated.

3. UDOT should continue to work with local and county agencies in meeting overall mobility goals and providing alternatives for active transportation, while also educating the public on the benefits of bicycle use and the increased livability and sustainability as a result of this use.

It is also encouraged that future research be performed on the impacts of bicycle corridors on travel demands using this research as a baseline. Three ideas for future research recommended are: 1) analyze the different types of bicycle infrastructure throughout the state and provide a comparison, 2) establish bicycle volume adjustment factors for Utah, and 3) evaluate roadways before and after the installation of bicycle infrastructure to determine the specific impacts of the bicycle infrastructure including the operational and safety impacts of bicycle infrastructure.

7.5 Implementation Plan

Three recommendations were made to UDOT in the previous section. The first recommendation is for UDOT to participate in active transportation throughout the state. The implementation plan for this recommendation would be for UDOT to encourage and lead in the development of active transportation. The internal survey revealed that approximately 3 out of 4 UDOT employees are familiar with the *Inclusion of Active Transportation* policy. It is important that UDOT educate their employees on the policy and strive to educate city and county governments on the importance of active transportation as well.

The second recommendation is for UDOT to focus installation of bicycle infrastructure on lower speed roadways. The implementation of this recommendation would be to identify lower speed roadways in the state and consider installing bicycle infrastructure on the roadways before considering roadways with higher speeds.

The last recommendation would be to work closely with local and county agencies, as well as the general public, in providing alternatives for active transportation throughout the state. This research has shown that it is the lower speed and volume roadways that attract more cyclists. Roadways that would be best suited for bicycle infrastructure would be lower speed and volume as well as roadways maintained by local governments. UDOT is encouraged to work closely with city and county agencies in the installation of bicycle infrastructure on roadways in communities where a bicycle lane would be most beneficial and used.

In addition to three recommendations to UDOT, three future research projects are encouraged to be performed under the direction of UDOT. The first is to analyze the different bicycle infrastructure types across the state and compare them to provide input on which types of infrastructure would be best suited for UDOT needs. This research would provide information to where a particular bicycle infrastructure should be placed to provide the most efficient use of the infrastructure and roadway. This would be done by evaluating the eight infrastructure types classified by AASHTO (2012). It would be recommended that the research study each infrastructure in as many different environments as possible with variables including but not limited to: AADT, posted speed, number of lanes, roadway classification, land use, access points, and pavement type. As part of this research project it is encouraged to consider the width of roadways and bicycle infrastructure and to review the effects.

The second future research project recommended would be to establish bicycle adjustment factors for Utah. Bicycle adjustment factors allow bicycle volumes to be adjusted to Annual Average Daily Bicycle Traffic (AADBT). AADBT can be used to provide a comparison of vehicular volumes to bicycle volumes which would provide useful information on the impacts of bicycle corridors on travel demands. Several factors affect bicycle rate such as weather and time of year. With adjustment factors established the AADBT could be calculated using short periods of bicycle volumes. It is recommended that several sites throughout the state be selected and permanent bicycle counters be installed and evaluated.

The final future research project recommended would be to evaluate roadways before and after the installation of bicycle infrastructure including the operational and safety impacts of bicycle lanes. This project would exist in several phases and over multiple years. Roadways that have been identified to have a bicycle infrastructure installed must have both bicycle and vehicle volumes collected and analyzed before the installation occurs. After the infrastructure has been installed volumes would again be collected and compared to the previous volumes. This would provide insight to the impacts of bicycle corridors on travel demands that could lead to further developments in active transportation.

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APPENDIX A. LIST OF ACRONYMS

AADBT	Annual Average Daily Bicycle Traffic
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ANOVA	Analysis of Variance
BTIP	Bike Transportation Improvement Program
BURA	Boulder Urban Renewal Authority
BVSD	Boulder Valley School District
CDOT	Colorado Department of Transportation
CU	University of Colorado Boulder
DOT	Department of Transportation
HMA	Hot Mix Asphalt
MAG	Mountainland Association of Governments
MnDOT	Minnesota Department of Transportation
ODOT	Oregon Department of Transportation
PCC	Portland Cement Concrete
PDD	Project Definition Document
TAC	Technical Advisory Committee
UCATS	Utah Collaborative Active Transportation
UDOT	Utah Department of Transportation

USDOT	United States Department of Transportation
vpd	vehicles per day
WFRC	Wasatch Front Regional Council
WSDOT	Washington State Department of Transportation

APPENDIX B. MANUAL COUNT METHOD

The worksheet used when collecting bicycle volumes via the manual count method is provided in this appendix. The worksheet is divided into six subjects with 11 subdivisions. The six subjects that were recorded are as follows: 1) total bicycle volumes, 2) gender of the cyclists, 3) purpose of using a bicycle, 4) direction, 5) use of sidewalk, and 6) age.

Manual Count Worksheet

Location: ______________________________

Date: ______________________________

Conditions: ______________________________

AM

Interval	Biker	Male	Female	Recreation	Commute	NB/EB	SB/WB	Sidewalk	Youth	Adult	Senior
7:00 - 7:15											
7:15 - 7:30											
7:30 - 7:45											
7:45 - 8:00											
8:00 - 8:15											
8:15 - 8:30											
8:30 - 8:45											
8:45 - 9:00											

Notes:

Noon

Interval	Biker	Male	Female	Recreation	Commute	NB/EB	SB/WB	Sidewalk	Youth	Adult	Senior
11:00 - 11:15											
11:15 - 11:30											
11:30 - 11:45											
11:45 - 12:00											
12:00 - 12:15											
12:15 - 12:30											
12:30 - 12:45											
12:45 - 1:00											

Notes:

PM

Interval	Biker	Male	Female	Recreation	Commute	NB/EB	SB/WB	Sidewalk	Youth	Adult	Senior
4:30 - 4:45											
4:45 - 5:00											
5:00 - 5:15											
5:15 - 5:30											
5:30 - 5:45											
5:45 - 6:00											
6:00 - 6:15											
6:15 - 6:30											

Notes:

Figure A-1: Manual count method worksheet.

APPENDIX C. ROAD ATTRIBUTES/CYCLISTS SUMMARY SHEET

The summarized raw volume data for each site along with descriptive information about the road itself is provided in the appendix. Details found in the worksheet are: 1) county, 2) city, 3) site location, 4) type of bicycle infrastructure, 5) road classification, 6) pavement type, 7) AADT, 8) number of lanes, 9) posted speed limit, 10) segment length, 11) access points, and 12) volume counts.

Table B.1: Road Attributes and Cyclists Summary

				Road Attributes										Cyclists Counts		
County	City	Site Location	Bicycle Infrastructure	Classification	Pavement	AADT (2013)	Number of Lanes	Posted Speed (MPH)	Segment Length (mi)	Residential Access Points	Commercial Access Points	Total Access Points	Density (access/mile)	Morning Cyclists	Noon Cyclists	Evening Cyclists
Weber	Ogden	Grant Ave 2125 South	Protected Bike Lane	Major Collector	PCC	3,105	2	20	0.43	0	9	9	20.9	5	9	16
		Lincoln Ave 2125 South	None	Major Collector	HMA	4,375	2	30	0.43	3	16	19	44.2	11	9	11
		Grant Ave 2550 South	Paved Shoulder	Major Collector	HMA	3,320	2	30	0.43	2	22	24	55.8	11	7	14
		Lincoln Ave 2550 South	None	Major Collector	HMA	3,695	2	30	0.43	3	26	29	67.4	8	13	13
Davis	Syracuse	1700 South 1518 West	Bike Lane	Other Principal Arterial	PCC	24,890	4	45	0.45	20	4	24	53.3	7	3	1
		2700 South 1518 West	None	Major Collector	HMA	1,905	2	35	0.43	40	0	40	93.0	24	4	5
Salt Lake	Salt Lake	Main Street 550 South	Marked Shared Lane	Major Collector	PCC	6,210	2	20	0.45	0	12	12	26.7	28	32	54
		500 East 750 South	Shared Lane (No Special Provisions)	Major Collector	HMA	5,460	4	30	0.45	35	5	40	88.9	18	24	35
		600 East 550 South	Bicycle Boulevard	Local	HMA	-	2	25	0.45	13	13	26	57.8	30	16	38
		SR 71 550 South	Paved Shoulder	Other Principal Arterial	HMA	37,950	6	40	0.45	10	20	30	66.7	8	11	22
	Sandy	SR 71 9662 South	Bike Lane	Other Principal Arterial	HMA	23,975	4	40	0.5	1	24	25	50.0	32	22	31
		State Street 9662 South	None	Other Principal Arterial	HMA	28,085	6	40	0.55	2	10	12	21.8	3	3	7
	South Jordan	10600 South 1450 West	Bike Lane	Other Principal Arterial	HMA	35,580	4	40	0.56	1	5	6	10.7	6	2	6
		11400 South 1250 West	Bike Lane	Other Principal Arterial	PCC	18,945	4	45	0.59	0	0	0	0.0	11	2	10
Utah	Orem	800 North 480 West	Shared Use Path (Adjacent to Roadways)	Other Principal Arterial	PCC	31,560	6	45	0.25	0	3	3	12.0	6	4	4
		400 North 350 West	Bike Lane	Major Collector	HMA	8,940	2	35	0.37	26	2	28	75.7	14	4	14
		800 South 482 West	Bike Lane	Minor Arterial	HMA	7,820	2	25	0.39	34	0	34	87.2	9	7	12
		400 South 480 West	None	Major Collector	HMA	4,485	2	25	0.25	9	2	11	44.0	19	12	17
		Orem Boulevard 250 North	Bike Lane	Major Collector	HMA	7,795	2	35	0.28	1	9	10	35.7	6	3	6
		400 West 250 North	None	Major Collector	HMA	7,485	2	25	0.35	31	5	36	102.9	17	12	12
	Provo	University Avenue Marrcrest East	Shared Use Path (Adjacent to Roadways)	*	HMA	*	*	*	0.3	0	0	0	0.0	27	20	35
		North Canyon Road 2850 North	None	Minor Arterial	HMA	8,220	2	35	0.27	15	1	16	59.3	18	8	14
		Provo River Trail 1720 North	Shared Use Path (Independent right-of-way)	*	HMA	*	*	*	*	*	*	*	*	23	13	32
		Freedom Boulevard 1720 North	None	Minor Arterial	HMA	13,725	4	35	0.3	1	13	14	46.7	10	9	25
		800 North 400 West	Bike Lane	Minor Arterial	HMA	10,320	2	25	0.28	11	6	17	60.7	39	14	36
		500 North 400 West	None	Major Collector	HMA	8,870	2	25	0.28	7	4	11	39.3	9	16	18
		Freedom Boulevard 650 North	Paved Shoulder	Minor Arterial	HMA	16,070	4	35	0.27	0	9	9	33.3	24	15	36
		500 West 650 North	None	Other Principal Arterial	HMA	30,545	4	30	0.27	6	9	15	55.6	32	18	29
		Freedom Boulevard 450 South	Bike Lane	Major Collector	HMA	6,945	2	30	0.27	11	6	17	63.0	29	20	25
		500 West 450 South	None	Minor Arterial	HMA	7,425	2	30	0.27	13	10	23	85.2	6	6	14
		Center Street 350 East	Bike Lane	Minor Arterial	HMA	6,780	2	30	0.27	21	5	26	96.3	21	14	12
		300 South 330 East	None	Other Principal Arterial	HMA	13,615	4	35	0.27	22	1	23	85.2	8	9	14
		200 East 450 North	Marked Shared Lane	Local	HMA	-	2	25	0.28	20	1	21	75.0	23	22	25
		100 East 450 North	None	Local	HMA	-	2	25	0.28	15	4	19	67.9	15	9	26
	Springville	Center Street 300 East	Bike Lane	Major Collector	HMA	6,305	2	30	0.29	24	2	26	89.7	11	7	10
		100 South 300 East	None	Local	HMA	-	2	25	0.29	25	0	25	86.2	1	3	3
Washington	St. George	700 East 150 South	Paved Shoulder	Major Collector	HMA	9,910	2	30	0.35	5	11	16	45.7	2	0	4
		600 East 150 South	None	Local	HMA	-	2	25	0.35	23	4	27	77.1	2	2	0
		400 East 350 South	Paved Shoulder	Major Collector	HMA	5,500	2	25	0.35	29	5	34	97.1	7	2	6
		600 East 150 South	None	Local	HMA	-	2	25	0.35	23	4	27	77.1	2	2	0
		300 South 650 East	Bike Lane	Local	HMA	-	2	25	0.32	22	6	28	87.5	7	1	1
		400 South 650 East	None	Local	HMA	-	2	25	0.35	29	0	29	82.9	1	1	0

APPENDIX D. DATA EVALUATION GRAPHICS

Scatterplots and box plots of additional analysis that was conducted but was not included in the thesis are provided in the appendix. The scatterplots presented are for AM and PM bicycle rates when comparing AADT and posted speed limit. The box plots presented are for AM and PM bicycle rates when comparing number of lanes and roadway classification.

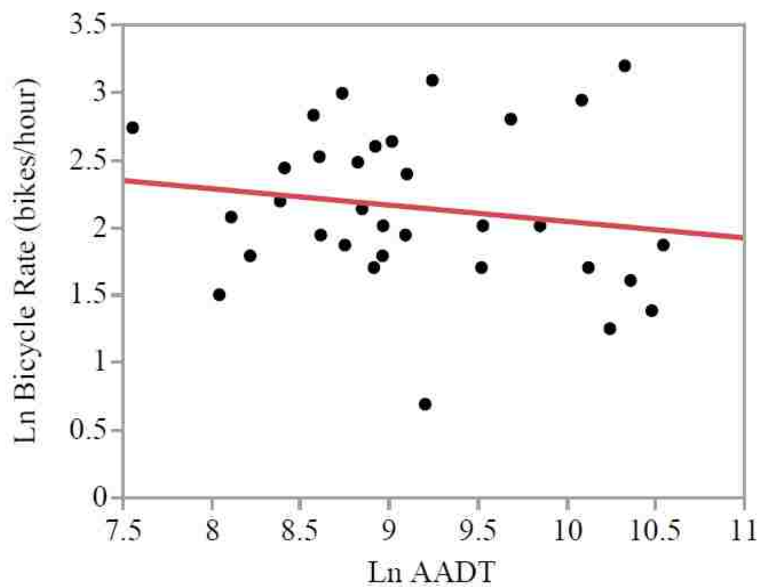

Figure C-1: AM bike rate compared to AADT for all sites.

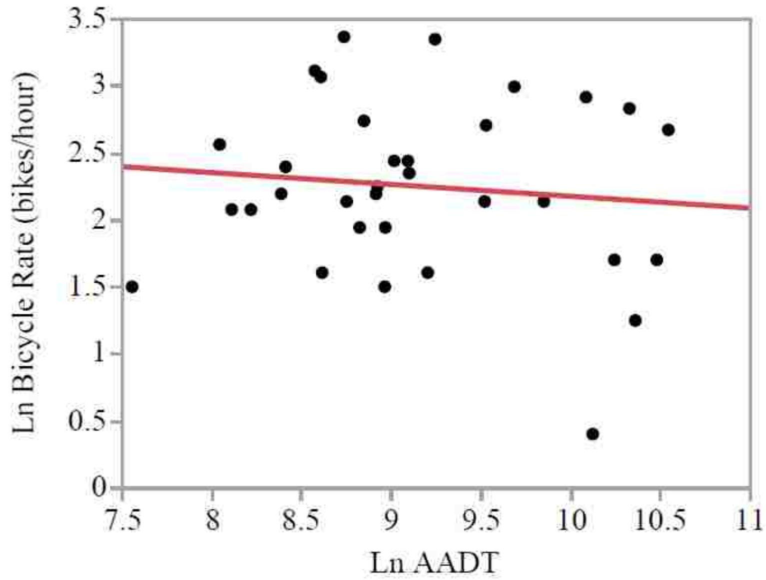

Figure C-2: PM bicycle rates compared to AADT for all sites.

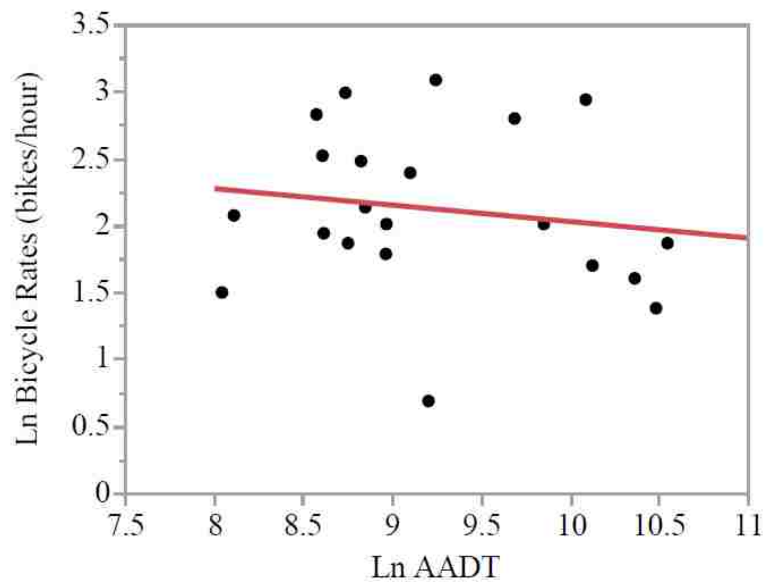

Figure C-3: AM bicycle rates compared to AADT for infrastructure roads.

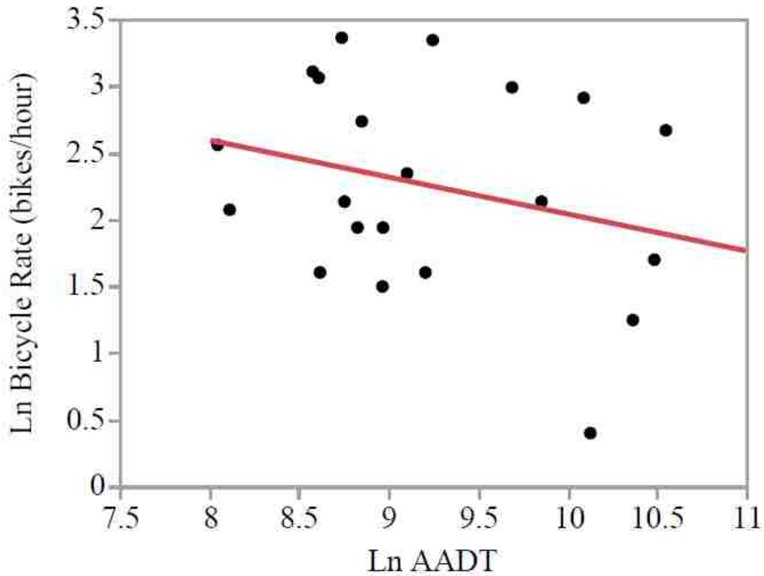

Figure C-4: PM bicycle rates compared to AADT for infrastructure roads.

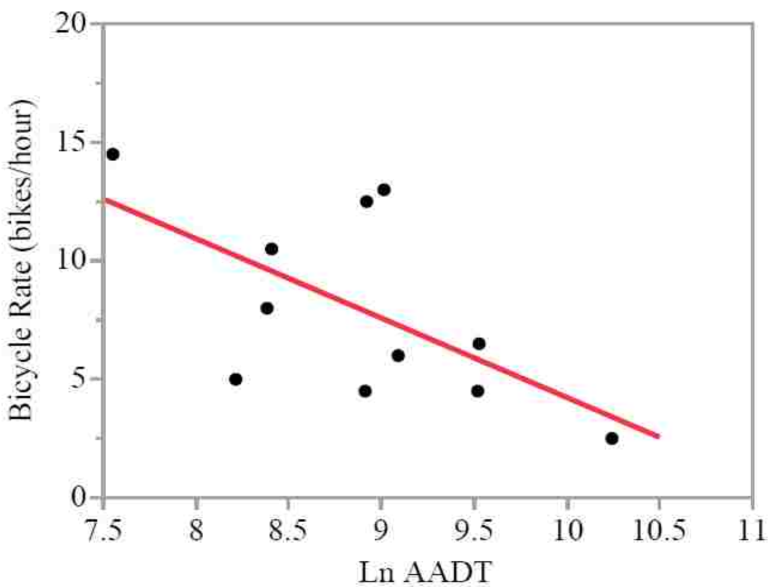

Figure C-5: AM bicycle rates compared to AADT for non-infrastructure roads.

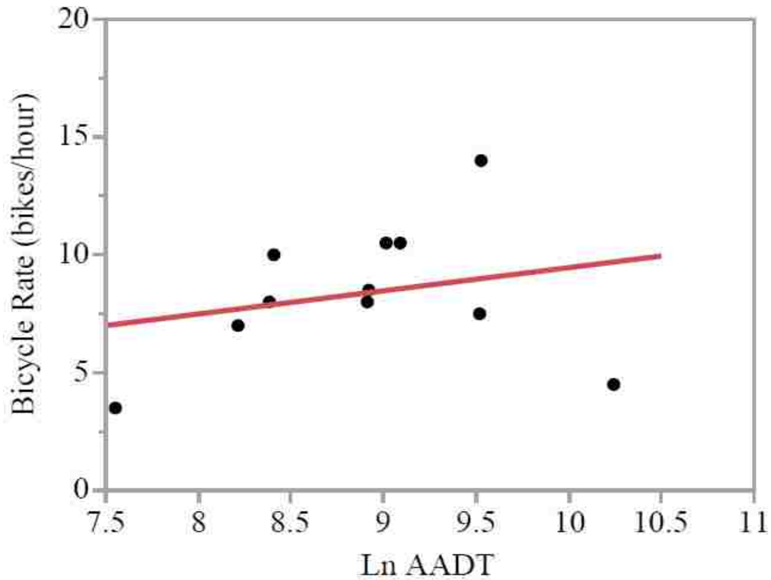

Figure C-6: PM bicycle rates compared to AADT for non-infrastructure roads.

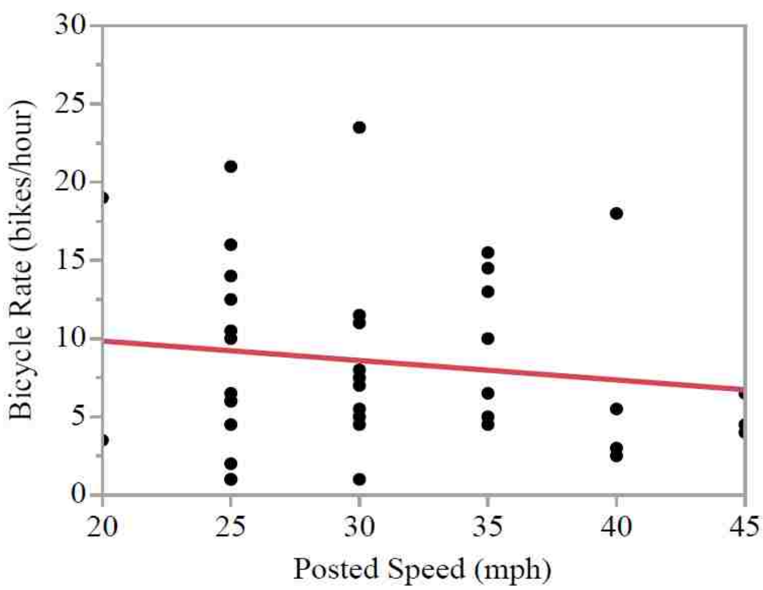

Figure C-7: AM bicycle rates compared to posted speed limit for all sites.

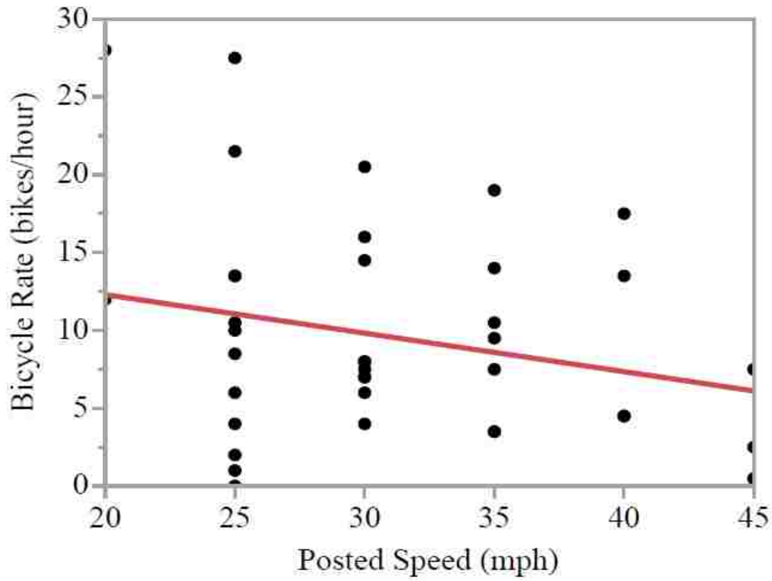

Figure C-8: PM bicycle rates compared to posted speed limit for all sites.

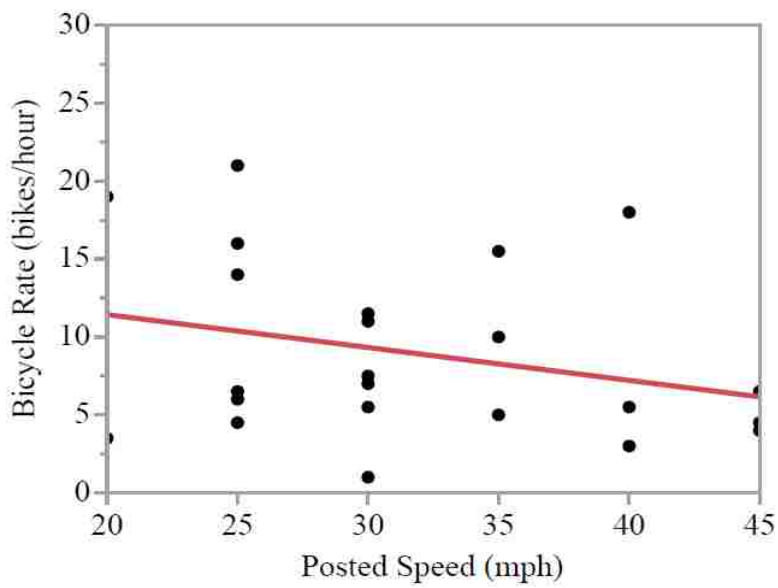

Figure C-9: AM bicycle rates compared to posted speed limit for infrastructure roads.

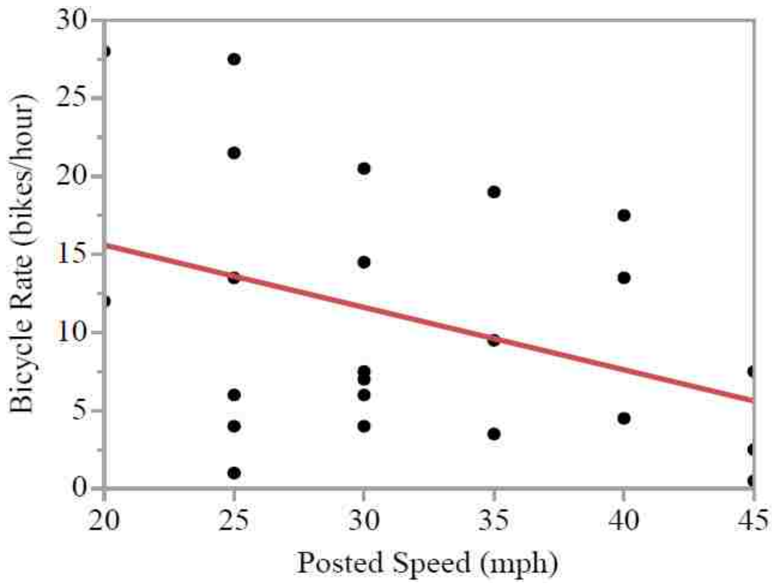

Figure C-10: PM bicycle rates compared to posted speed limit for infrastructure roads.

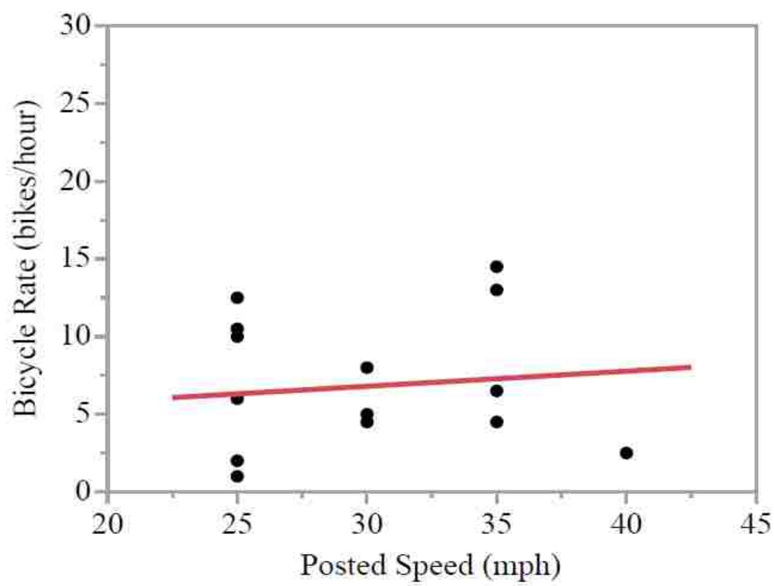

Figure C-11: AM bicycle rates compared to posted speed limit for non-infrastructure roads.

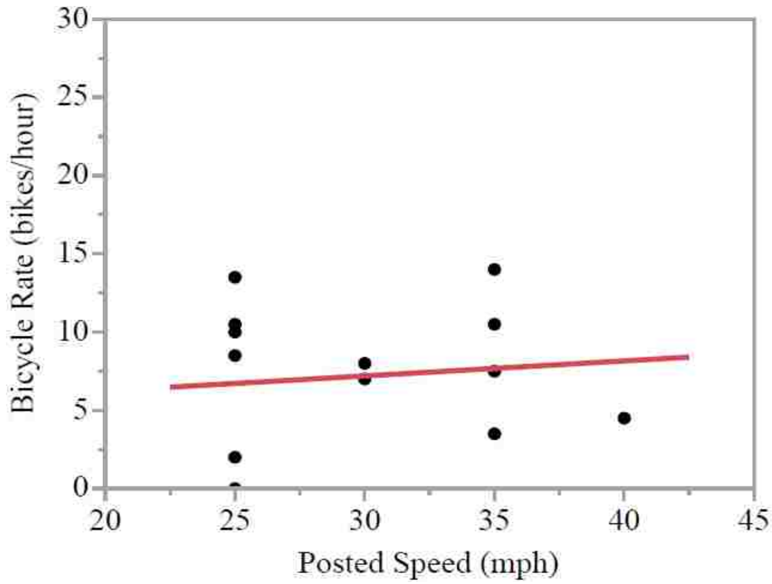

Figure C-12: PM bicycle rates compared to posted speed limit for non-infrastructure roads.

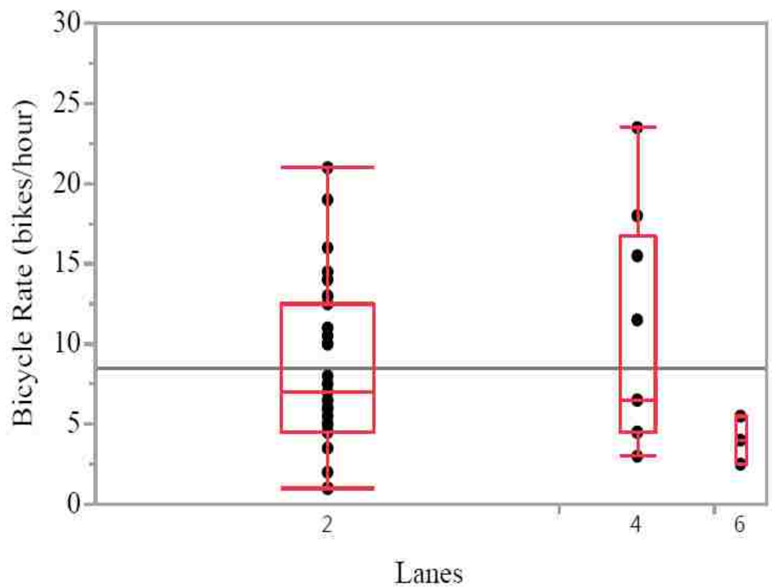

Figure C-13: AM bicycle rates compared to number of lanes for all sites.

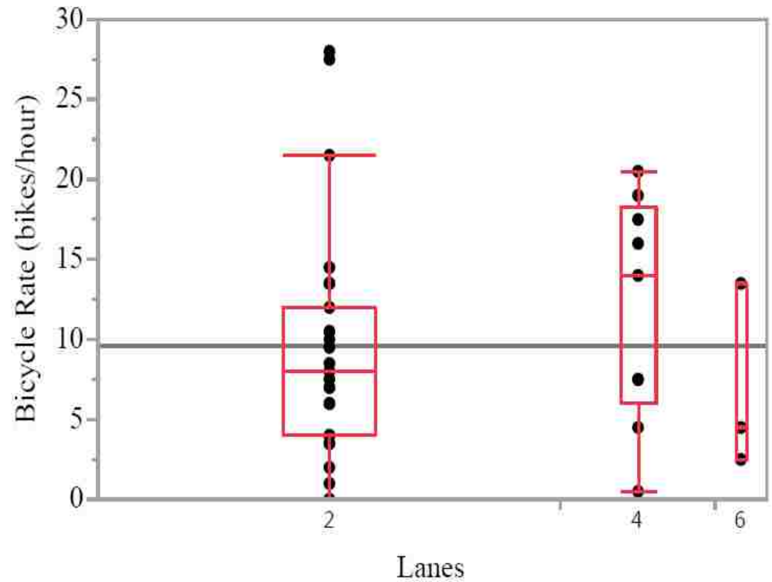

Figure C-14: PM bicycle rates compared to number of lanes for all sites.

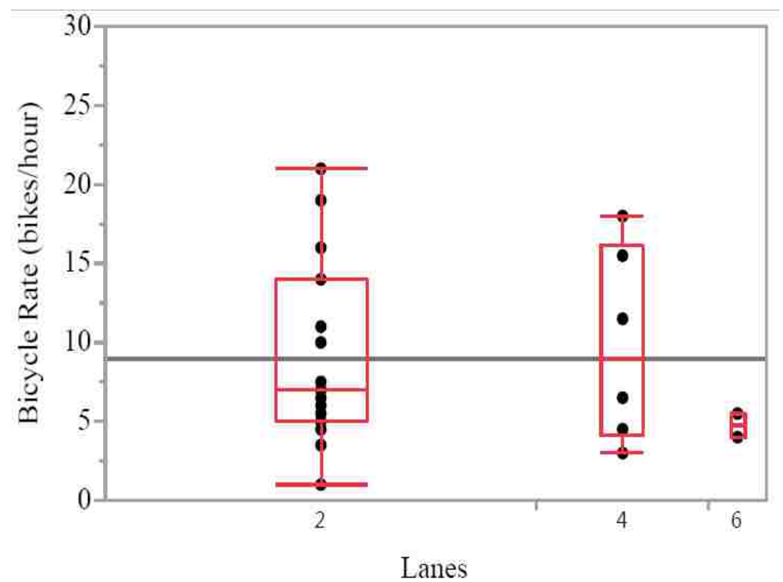

Figure C-15: AM bicycle rates compared to number of lanes for infrastructure roads.

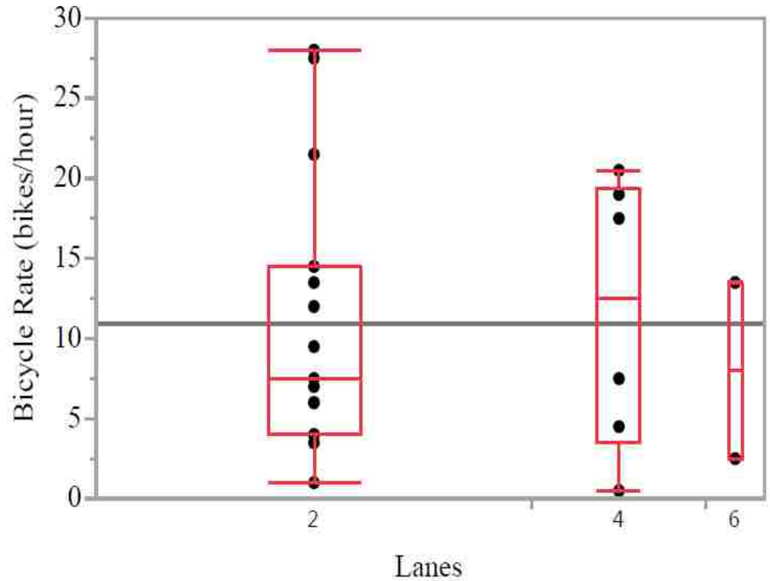

Figure C-16: PM bicycle rates compared to number of lanes for infrastructure roads.

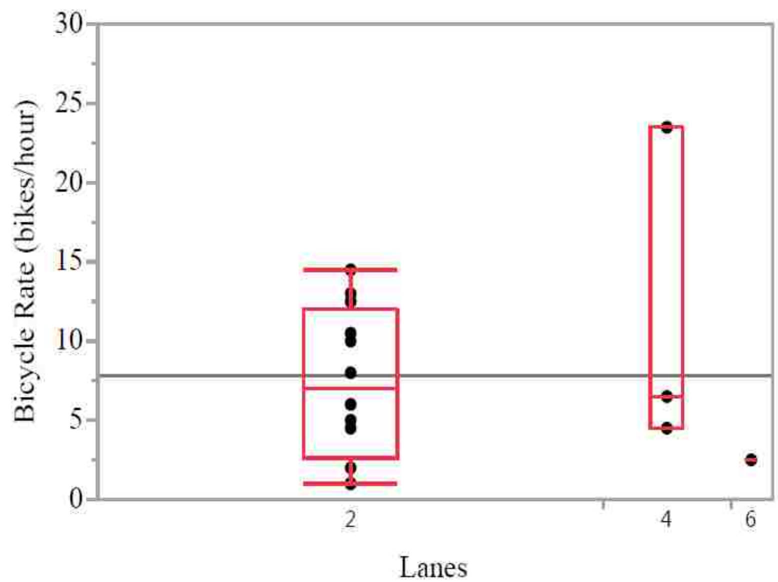

Figure C-17: AM bicycle rates compared to number of lanes for non-infrastructure roads

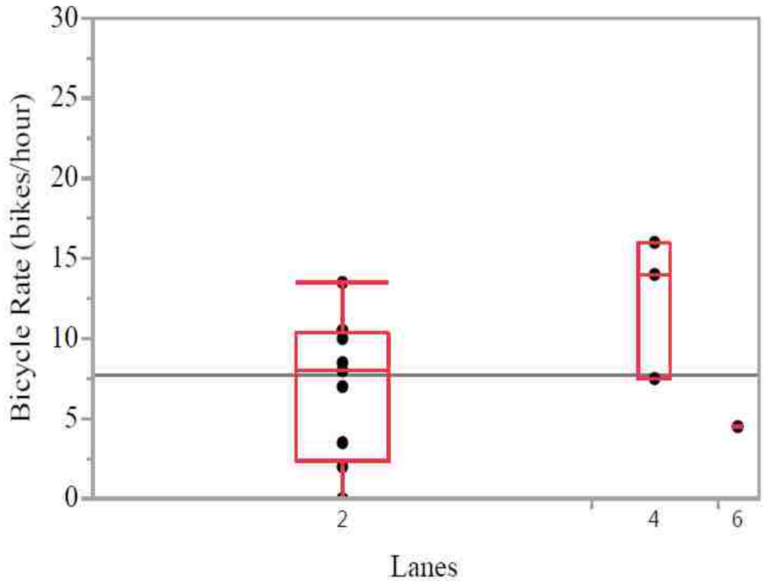

Figure C-18: PM bicycle rates compared to number of lanes for non-infrastructure roads

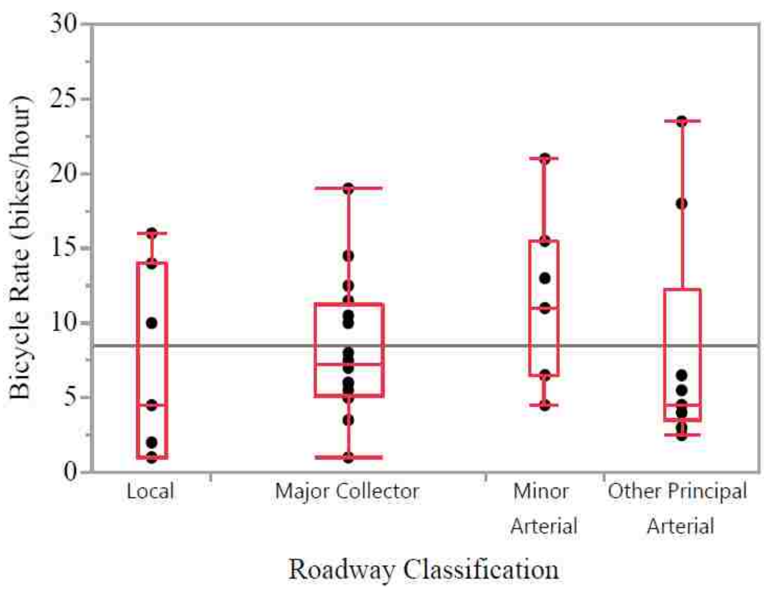

Figure C-19: AM bicycle rates compared to road classifications for all sites.

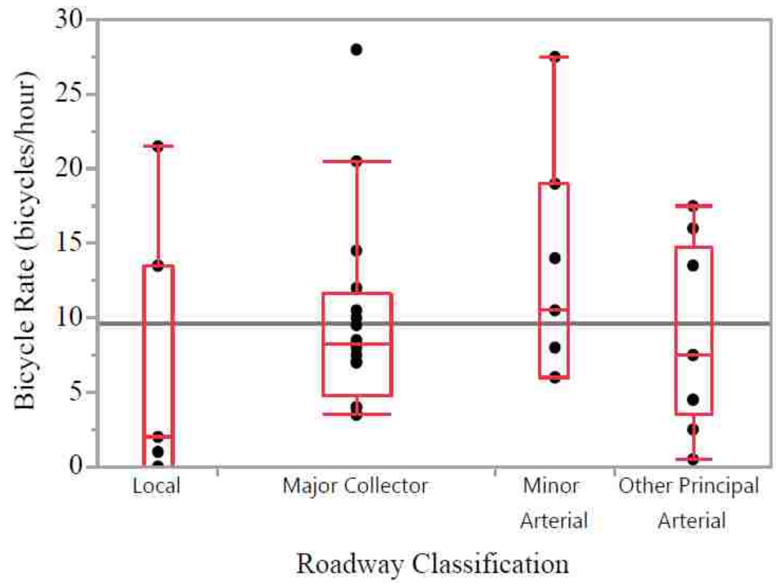

Figure C-20: PM bicycle rates compared to road classification for all sites.

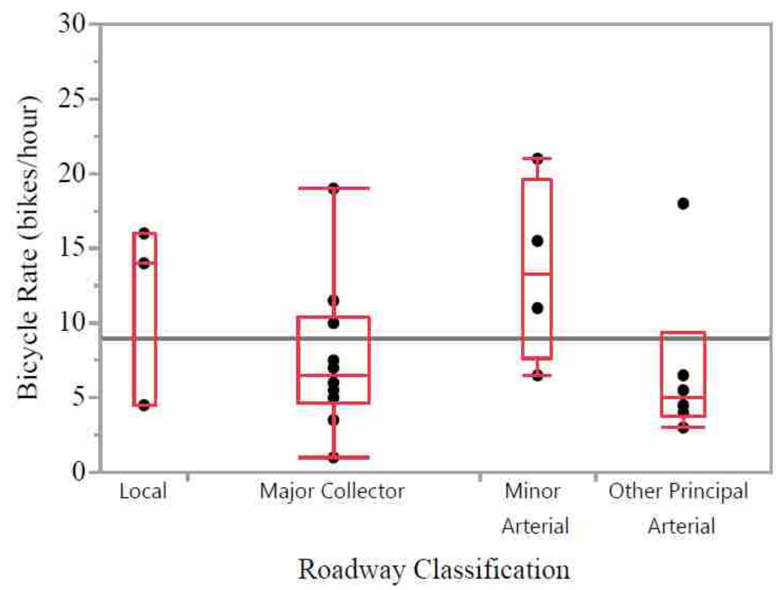

Figure C-21: AM bicycle rates compared to road classification for bicycle infrastructure roads.

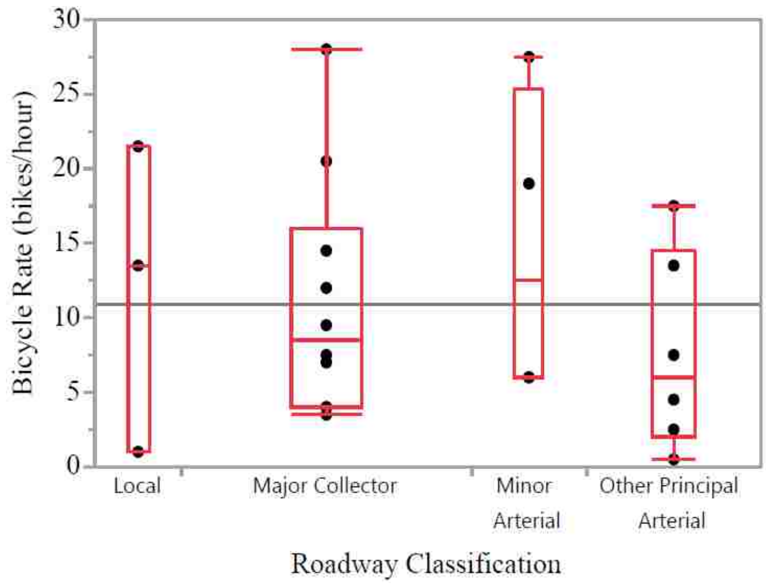

Figure C-22: PM bicycle rates compared to road classification for bicycle infrastructure roads

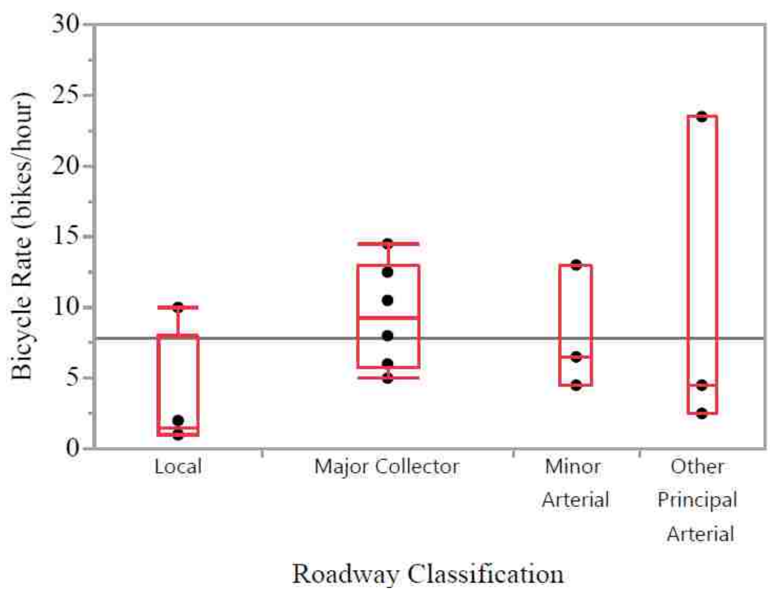

Figure C-23: AM bicycle rates compared to road classification for non-infrastructure roads

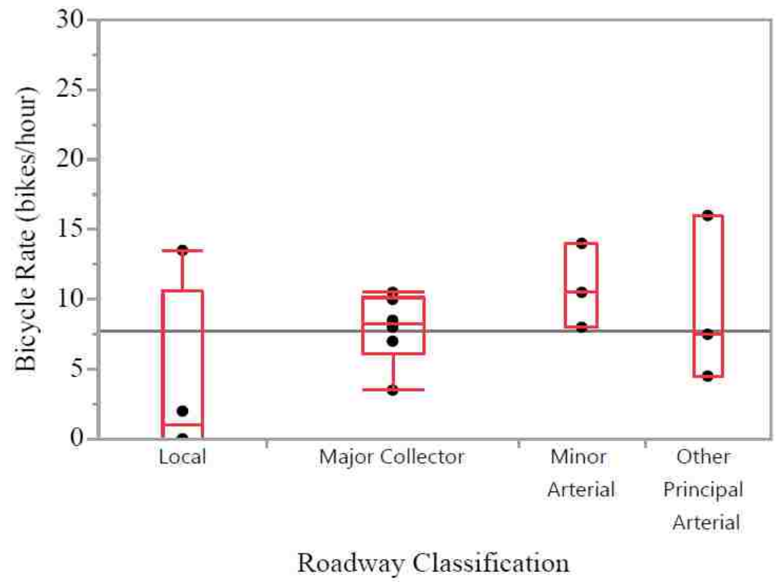

Figure C-24: PM bicycle rates compared to road classification for non-infrastructure roads

APPENDIX E. DATA EVALUATION TABLES

Tables containing p-values of additional analysis that was conducted but was not included in the thesis are found below. The tables presented are for AM and PM bicycle rates when comparing AADT, posted speed limit, number of lanes, and road classification.

Table D.1: P-value for AM Bicycle Rates Compared to AADT for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	3.2581473	1.220156	2.67	0.0120	0.7696224	5.7466723
Ln AADT	-0.121204	0.132959	-0.91	0.3690	-0.392376	0.1499669

Table D.2: P-value for PM Bicycle Rates Compared to AADT for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	3.0597539	1.362907	2.25	0.0320	0.2800868	5.839421
Ln AADT	-0.088117	0.148514	-0.59	0.5573	-0.391014	0.2147797

Table D.3: P-value for AM Bicycle Rates Compared to AADT for Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	3.263128	1.682985	1.94	0.0675	-0.259399	6.7856554
Ln AADT	-0.122992	0.181895	-0.68	0.5071	-0.503702	0.2577182

Table D.4: P-value for PM Bicycle Rates Compared to AADT for Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	4.8139648	2.05888	2.34	0.0305	0.5046786	9.1232509
Ln AADT	-0.276809	0.222521	-1.24	0.2286	-0.742552	0.1889329

Table D.5: P-value for AM Bicycle Rates Compared to AADT for Non-Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	37.777312	12.93543	2.92	0.0170	8.5153374	67.039286
Ln AADT	-3.354778	1.450595	-2.31	0.0460	-6.636252	-0.073303

Table D.6: P-value for PM Bicycle Rates Compared to AADT for Non-Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	-0.378446	11.4027	-0.03	0.9742	-26.17314	25.416251
Ln AADT	0.9834011	1.278713	0.77	0.4616	-1.909249	3.8760508

Table D.7: P-value for AM Bicycle Rates Compared to Posted Speed Limit for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	12.333456	4.388463	2.81	0.0079	3.4415857	21.225326
Ln AADT	-0.124485	0.13882	-0.90	0.3757	-0.405761	0.1567905

Table D.8: P-value for PM Bicycle Rates Compared to Posted Speed Limit for All Sites

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	17.241728	5.278295	3.27	0.0024	6.5468857	27.93657
Ln AADT	-0.247243	0.166968	-1.48	0.1471	-0.585552	0.0910664

Table D.9: P-value for AM Bicycle Rates Compared to Posted Speed Limit for Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	15.654412	5.005691	3.13	0.0051	5.2445081	26.064315
Ln AADT	-0.211029	0.153372	-1.38	0.1833	-0.529983	0.1079242

Table D.10: P-value for PM Bicycle Rates Compared to Posted Speed Limit for Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	23.593137	6.911692	3.41	0.0026	9.2194863	37.966788
Posted Speed (mph)	-0.39951	0.21177	-1.89	0.0731	-0.83991	0.0408909

Table D.11: P-value for AM Bicycle Rates Compared to Posted Speed Limit for Non-Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	3.8794643	7.16612	0.54	0.5974	-11.602	19.360926
Posted Speed (mph)	0.0973214	0.23821	0.41	0.6895	-0.4173	0.6119426

Table D.12: P-value for PM Bicycle Rates Compared to Posted Speed Limit for Non-Infrasture Roads

Term	Estimate	Std Error	t Ratio	Prob > |t|	Lower 95%	Upper 95%
Intercept	4.3191964	7.05462	0.61	0.5509	-10.92138	19.559776
Posted Speed (mph)	0.0959821	0.234503	0.41	0.6890	-0.410632	0.6025961

Table D.13: P-value for AM Bicycle Rates Compared to Number of Lanes for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	93.4473	46.7236	1.4293	0.2527
Error	36	1176.7963	32.6888		
Total	38	1270.2436			

Table D.14: P-value for PM Bicycle Rates Compared to Number of Lanes for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	75.6268	37.8134	0.7441	0.4823
Error	36	1829.4630	50.8184		
Total	38	1905.0897			

Table D.15: P-value for AM Bicycle Rates Compared to Number of Lanes for Infrasture Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	40.66486	20.3324	0.6017	0.5575
Error	20	675.79167	33.7896		
Total	22	716.45652			

Table D.16: P-value for PM Bicycle Rates Compared to Number of Lanes for Infrasture Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	19.8844	9.9422	0.1376	0.8723
Error	20	1445.4417	72.2721		
Total	22	1465.3261			

Table D.17: P-value for AM Bicycle Rates Compared to Number of Lanes for Non-Infrasture Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	71.77083	35.8854	0.9933	0.3968
Error	13	469.66667	36.1282		
Total	15	541.43750			

Table D.18: P-value for PM Bicycle Rates Compared to Number of Lanes for Non-Infrasture Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Number of Lanes	2	89.25521	44.6276	2.2820	0.1414
Error	13	254.22917	19.5561		
Total	15	343.48438			

Table D.19: P-value for AM Bicycle Rates Compared to Road Classification for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	69.1878	23.0626	0.6721	0.5749
Error	35	1201.0558	34.3159		
Total	38	1270.2436			

Table D.20: P-value for PM Bicycle Rates Compared to Road Classification for All Sites

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	134.4270	44.8090	0.8857	0.458
Error	35	1770.6627	50.5904		
Total	38	1905.0897			

Table D.21: P-value for AM Bicycle Rates Compared to Road Classification for Bicycle Infrastructure Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	145.34819	48.4494	1.6118	0.2198
Error	19	571.10833	30.0583		
Total	22	716.45652			

Table D.22: P-value for PM Bicycle Rates Compared to Road Classification for Bicycle Infrastructure Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	122.0803	40.6934	0.5756	0.6380
Error	19	1343.2458	70.6971		
Total	22	1465.3261			

Table D.23: P-value for AM Bicycle Rates Compared to Road Classification for Bicycle Non-Infrastructure Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	106.56250	35.5208	0.9802	0.4345
Error	12	434.87500	36.2396		
Total	15	541.43750			

Table D.24: P-value for PM Bicycle Rates Compared to Road Classification for Bicycle Non-Infrastructure Roads

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Road Classification	3	96.25521	32.0851	1.5573	0.2508
Error	12	247.22917	20.6024		
Total	15	343.48438			